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Merchant Interconnection in the Internal Energy Market

Implications of the Network Code on Capacity Allocation and Congestion Management

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Abstract

This study investigates the impact of the Network Code on Capacity Allocation (CACM) on the merchant approach to interconnector development. It also situates CACM in the context of the EU, analysing the progress it makes towards a functioning single market for electricity across European Member States. Known as the Internal Energy Market (IEM), the EU has worked to achieve a single market for over 20 years, with a series of legislative reforms beginning in 1996. With the development of interconnection recognised as vital to this project, it is important to understand the impacts of new legislation. This thesis thus uses a literature review, a legal approach to understanding the regulatory text, and expert interviews to both develop an understanding of the context of interconnector development and an understanding of what may change as a result of CACM. The study finds that CACM is likely to increase costs and lead to worsened commercial conditions for merchant interconnector developers. Ambiguity surrounding methodologies for capacity calculation and cost recovery may make it hard for developers to model a long-term business case, leading to fewer interconnector projects moving forward. This would be detrimental to the EU, with a lack of cross-border transmission capacity long identified as a barrier to a functioning IEM.

Keywords: Interconnection, CACM, Network Codes, Merchant approach, Internal Energy Market

Executive Summary

This thesis investigates the impact that the Network Code on Capacity Allocation and Congestion Management (CACM) will have on the merchant approach to interconnection. The research is focussed on the case of the United Kingdom, where the use of this approach is most prominent, with the predominant model in other EU Member States known as the 'regulated' approach. It also aims to situate CACM in the context of the EU's drive for an Internal Energy Market (IEM), assessing what progress it makes towards the realisation of a functioning single market for electricity in the EU. The EU has introduced a series of legislative reforms since the 1990s with the aim of liberalising energy markets and developing a single market for electricity in order to increase 'social welfare' for European consumers. It argues that an IEM will help to increase security of supply, lower prices for Europeans and facilitate further penetration of renewable energy. Key aspects to such a market are: a level playing field for all parties, a functioning marketplace for transactions, and an adequate supply of both electricity and transmission capacity. There is recognition that none of these conditions are yet in place, despite the legislative reforms and the widely publicised benefits.

There is currently a range of approaches to capacity allocation and congestion management in European electricity markets. To ensure a level playing field in a single market, CACM aims to harmonise these approaches. As part of the wider project of Europe-wide Network Codes, CACM thus represents further progress towards the design of a single market for electricity across all Member States. This harmonisation will have wide-ranging impacts on electricity markets in Europe, including for the development of interconnectors. The problem addressed in this study is the lack of existing research on the impacts of CACM, with the author recognising a gap in the literature – likely due to the fact that CACM has only recently entered into force on 20th August 2015. Thus, the research questions this study aims to answer are:

1. What are the different approaches to interconnection development?
2. Why does the UK favour a merchant model?
3. How will CACM affect the merchant business model for interconnection development?
4. How will CACM affect the development of the Internal Energy Market?

In order to achieve these objectives the author conducted a literature review, a legal analysis of the regulatory text of CACM, and expert interviews with stakeholders including interconnector developers, TSOs, Government and, the British energy regulator, OFGEM. An extensive literature review was undertaken to answer the first research question. To answer the second and third research questions, a multi-criteria analysis (MCA) was used. Based on a literature review, the author decided to investigate the *legitimacy, effectiveness* and *efficiency* of the merchant approach in the British context. Based on a legal reading of CACM and input from expert interviews, the author then reflected on the impacts of CACM on the *legitimacy, effectiveness* and *efficiency* of the merchant approach. The fourth research question was structured according to analysing the progress that CACM makes towards facilitating both a market design and the development of further interconnector capacity; both are vital for the IEM to function effectively. It is widely recognised that there is currently insufficient cross-border capacity, with a range of economic, regulatory and institutional barriers to development hampering progress in Member States.

This study found that whilst there are currently two approaches to interconnector development, a third 'cap and floor' approach has been developed. The merchant business model has been severely affected by EU regulation, which has led to 'de facto chilling effect' on investment since 2011. There are currently two projects due to begin construction under the cap and floor approach, with a further five approved to proceed under it. The cap and floor approach is 'semi-regulated', with profits capped and a 'floor' level of revenue set, to ensure that developers can

recoup their costs. Thus, it is more in line with the method for regulating the internal grid network. The UK favours the merchant approach because the energy regulator, OFGEM, believes that it is likely to secure the necessary investment with lower risks to consumers. With UK interconnectors being subsea, rather than overland, the costs associated with development, construction and maintenance are higher. Furthermore there is a risk that if market conditions become unfavourable, interconnectors could become stranded assets. Thus, whilst other Member States develop interconnection under a regulated approach, with costs passed onto consumers through higher network tariffs, the UK prefers a merchant approach where developers propose projects in response to price signals, taking the risk and the reward in return for the investment.

The study found that CACM is likely to increase costs and worsen the commercial conditions for merchant developers. A legal reading of the text indicated that the cost of ensuring firmness of capacity is to increase due to a different regime. Whilst regulated interconnectors can pass on increased costs through raising network tariffs, merchant interconnectors will see any increased cost as a reduction in revenue. This is likely to affect the business case moving forward. There is a risk that CACM will also worsen commercial conditions by increasing uncertainty for project developers. The expected review of bidding zones, the development of methodologies for harmonised capacity calculation and uncertainty over appropriate methods for cost recovery will all have implications. There is concern that the likely outcome of these reviews will further constrain the ability of merchant interconnectors to control revenue streams, with interviewees highlighting the impact of the capacity calculation methodology in particular. Furthermore, with the new cap and floor regime allowing for costs to be passed on to consumers should interconnector revenue drop below the floor level, any impacts as a result of CACM could be felt by UK customers. This represents a departure from the purely merchant approach, whereby both risk and reward was taken on by the developer. Further to this, for OFGEM to grant a developer a cap and floor regime, project owners need to have a well-defined business case with long-term estimates of costs and revenue. The developments outlined above may make it harder to accurately predict costs and revenues, leading to fewer projects moving forward. It may also make it harder for merchant projects to secure the considerable finance that is needed to bring interconnectors from the design to the operation phase. Based on this, the EU seems set to continue its restriction of the space for merchant developers to operate, in spite of the need for the development of further interconnection.

The author thus argues that whilst CACM and the wider Network Codes make progress towards the design of the IEM, through harmonising the rules that apply to electricity systems and markets in Europe, it may not lead to the development of further interconnection – particularly under the merchant approach. Furthermore, the development of methodologies and the reviews discussed above are likely to have differing impacts across Member States, creating winners and losers according to whether electricity prices are likely to rise or fall. Thus, there are likely to be political barriers to ensuring the market is designed in the most welfare enhancing fashion, as Member States seek to get the best deal for their consumers. Despite over 20 years of reforms, the author feels that CACM and the Network Codes represent the beginning of a new chapter in the development of the IEM, rather than its finalisation. Since this development of CACM is at an early stage, further research into the impacts of both it and the wider Network Codes will be of paramount importance in the future, for both policy makers and interconnector developers. With the Third Energy Package and the Network Codes assigning more power to pan-European institutions, reducing the sovereignty that Member States have, revisiting the implications of the Network Codes, CACM and the IEM from a federalist point of view would be timely.

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Abbreviations

ACER	Agency for the Cooperation of Energy Regulators
CACM	The Network Code on Capacity Allocation and Congestion Management
CMG	Congestion Management Guidelines
CREG	Commission de Régulation de l'Electricité et du Gaz
DECC	Department for Energy and Climate Change
EB	The Network Code on Electricity Balancing
EC	The European Commission
ERI	Electricity Regional Initiatives
ERGEG	European Regulators' Group for Electricity and Gas
EU	The European Union
ENTSO-E	The European Network of Transmission System Operators for Electricity
EUPHEMIA	EU + Pan-European Hybrid Electricity Market
FBM	Flow-Based Method
FCA	The Network Code on Forward Capacity Allocation
FG	Framework Guideline
HVAC	High-voltage Alternating Current
HVDC	High-voltage Direct Current

IEM	Internal Energy Market/ Internal Electricity Market
MCA	Multi-Criteria Analysis
NEMO	Nominated Energy Market Operator
NGET	National Grid Electricity Transmission
NOA	Network Options Assessment
NRA	National Regulatory Authority
NTC	Net Transmission Capacity
OFGEM	The Office of Gas and Electricity Markets
OJEU	The Official Journal of the European Union
PCI	Project of Common Interest
RAB	Regulated Asset Base
REM	Regional Energy Market
RES	Renewable Energy Source
SEA	Single European Act
SO	System Operator
TEN-E	Regulation on Trans-European Energy Networks
TEP	The Third Energy Package
TFEU	Treaty on the Functioning of the European Union
TPA	Third Party Access
TSO	Transmission System Operator
TYNDP	Ten Year Network Development Plan
UK	The United Kingdom
XBID	Cross-Border Intraday Market Project

1 Introduction

This Chapter begins by introducing the need for a transition to a new electricity system, an overview of some of the challenges facing the existing electricity system in the UK, and how interconnection can help to address some of these challenges. It then situates interconnectors in the context of the EU, outlining that despite further interconnection being beneficial, significant barriers exist in developing new projects. Finally, the legislation designed to complete the European Internal Energy Market is introduced. This legislation is fundamentally linked to the drive to increase interconnection between Member States.

1.1 Background

The provision of reliable and affordable electricity is an essential public good, vital to the effective functioning of modern society (Jones & Webster, 2006). The prevailing model for the development of electricity systems was to use large, centralised generators powered by fossil fuels (Philipson & Willis, 2006; Talus, 2013). This model has largely been successful, leading to an affordable, reliable supply of electricity for much of Europe; arguably one of the most important factors for 20th century development (Jones & Webster, 2006; Philipson & Willis, 2006; Talus, 2013). Generally, the development of the system was overseen by a regulated vertically integrated monopoly, responsible for generation, transmission, distribution and retail. In many cases, this company, or utility, was state owned (Joskow, 2008). This is displayed in Figure 1.

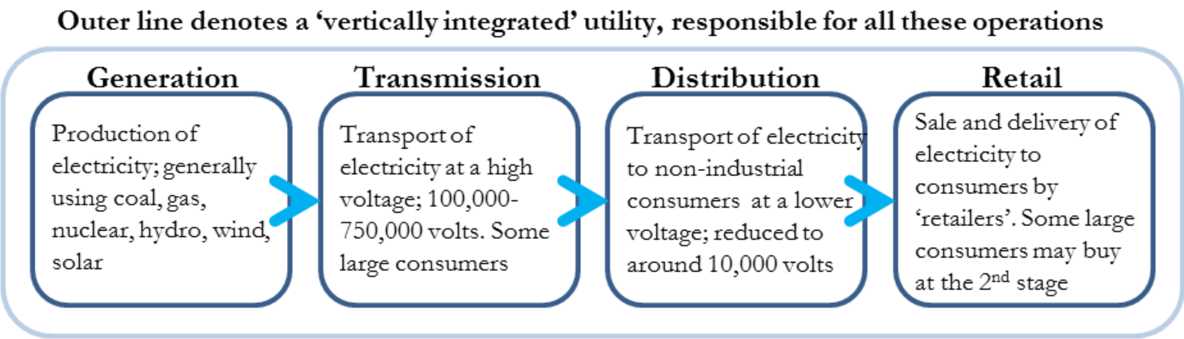

Figure 1: The stages of operation for electricity provision

Whilst we are lucky that in Europe most of us can take this successful system for granted, the use of fossil fuels has not been without consequence. Research has shown that energy produced by fossil fuels significantly contributes to climate change and air pollution, acidification, tropospheric ozone creation, waste generation, soil degradation, marine and coastal zone problems and technological hazard issues (Krämer, 2003). Thus, whilst previously the goal was a secure and affordable electricity supply a third focus has now come in; decarbonisation (Newbery, 2015). Problems associated with the burning of fossil fuels such as coal have been prominent since the 1950s, spanning issues such as air pollution in major European cities and acid rain in Scandinavia (Björkbom, 1999; Tuinstra, Hordijk, & Kroeze, 2006). Whilst end-of-pipe measures were seen to be the solution to these problems, it could be argued that there has been a much greater emphasis on decarbonisation of fuel sources since evidence emerged that emissions of greenhouse gasses from burning fossil fuels was a contributing factor to anthropogenic climate change (see, for example, IPCC, 1990). The most recent IPCC Report proves that assertion and confirms that efforts to reduce emissions have thus far been inadequate. There is widespread agreement that if we are to have any chance of mitigating climate change then a transformation is of paramount importance; both in how we produce and how we consume energy (Moomow et al., 2011; Pfenninger & Keirstead, 2015).

1.1.1 Challenges for the Electricity System

Both the United Kingdom and Europe face significant challenges if they are to solve this "trilemma" of security of supply, decarbonisation and affordability (DECC, 2012; ENTSO-E, 2014a; European Climate Foundation, 2011). There is a risk that the UK will face supply issues, with 20% of generation capacity coming offline in the next decade due to old age and more stringent pollution standards (DECC, 2012; National Grid, 2014). Furthermore, when it comes to emissions from electricity generation the UK is particularly culpable; in 2013 61% of electricity was generated by fossil fuel (DECC, 2014; Pfenninger & Keirstead, 2015). To address this, the Climate Change Act outlines an ambitious, legally binding target of reducing emissions by 80% relative to 1990 levels by 2050, whilst 15% of electricity generation capacity needs to come from renewable sources by 2015 (DECC, 2012). These targets help to drive demand for renewables and hasten the demise of the worst polluting fuels, such as coal. However, whilst further development of renewable capacity is important, it may not be able to solve the supply issues that the UK will face due to the intermittency of renewable generation and the current lack of availability of large-scale energy storage (Edmunds, Cockerill, Foxon, Ingham, & Pourkashanian, 2014; Gross et al., 2006; Skea et al., 2007).

Sørensen argues that "there is still what may be interpreted as a limited understanding of the detailed relationship between the intermittency of certain renewable energy sources and their abilities to match demands" (2015, p. 100). This is because the availability of renewable sources of energy, such as solar and wind, is dependent on the appropriate weather conditions. This makes them unreliable, which creates problems for the electricity network where supply needs to be balanced with demand on a second-by-second basis. Furthermore, it is currently difficult and expensive to store electricity in large quantities. This means that it would be hard to design an electricity system based on renewable sources, with the lack of flexibility impossible to manage for System Operators (SO).[1] As the politician Tom Greatrex said, Scotland has the wind capacity to provide for 117% of demand, but this does not always match up with when the supply is needed (Policy Exchange, n.d.). If supply is greater than demand then the excess load is shed to prevent system failure and damage to infrastructure which could lead to blackouts (Philipson & Willis, 2006).[2] This action ensures the system functions effectively but is inherently economically and environmentally inefficient as electricity is wasted; Roby notes that there are concerns that such action could be seen to represent a market failure to meet demand (Roby, 2013). Thus, whilst countries such as Germany have shown the world that renewables can help to *reduce dependence* on fossil fuels, in general the electricity system still needs to rely on coal or nuclear for baseload and gas for peak load (Bayer, 2015). Progress has been made, with 33% of electricity in Europe produced from renewable sources in 2014, up from 24% in 2010 (ENTSO-E, 2014a). Alongside the introduction of renewable energy supply, further reductions to dependence on fossil fuels can come through energy efficiency improvements, demand-side management and smarter grids (Lund, 2010). However, it is open to debate whether this will be enough to meet the IPCC targets.

This creates a problem; Britain needs to decarbonise its electricity system but without large-scale energy storage, renewables alone cannot offer the security of supply needed to ensure a functioning system – politically regarded as the most important of the 'trilemma' goals

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[1] There are examples of largely renewable-based systems, such as Norway, where hydro power is the predominant source of energy. Hydro power also acts as a de facto battery, whereby water can be pumped back up into dams at times of low price and releases when it is needed. However, hydro power is location-specific and thus this solution will not apply everywhere.

[2] Load shedding is the practice of turning off generating equipment that is not needed in order to balance the demand with the supply of electricity and reduce the risk of rolling blackouts that occur from overloading the transmission system. This tends to be more flexible renewable generation, such as wind, rather than inflexible baseload generation such as that provided by coal and nuclear power plants.

(Newbery, 2015). However, research has shown that linking electricity grids and markets through interconnection can facilitate greater penetration of intermittent renewables, such as solar and wind (Alexander, James, & Richardson, 2015; DECC, 2013; De Jonghe, Delarue, Belmans, & D'haeseleer, 2011; Edmunds et al., 2014; ENTSO-E, 2014a; European Climate Foundation, 2011; Moore & Newey, 2014; National Grid, 2014; Pfenninger & Keirstead, 2015; Sørensen, 2015). Interconnection is defined by the EU as a transmission line which crosses or spans a border between Member States and which connects the national transmission systems of the Member States.[3] Interconnectors allow for the import and export of electricity, allocating resources using price differentials in the two markets (Turvey, 2006). In theory, an interconnected system incurs lower operating costs than a purely national one, as it allows for excess supply in one area to be utilised in other areas where the marginal cost would be higher if there were no interconnection (Nepal & Jamasb, 2012). This leads to a more efficient allocation of generating capacity, with expensive generation capacity displaced in favour of cheaper electricity and less need for investment in new capacity (Turvey, 2006). A report by the UK Government backs up these assertions, adding that interconnection provided further competition in the generation market which leads to lower bills for consumers (DECC, 2013). Furthermore, access to a more diverse fleet of generating capacity can increase security of supply (Stirling, 2010). Overall, the Department of Energy and Climate Change (DECC) believes that interconnection has the potential to contribute to the Government's energy security, affordability and decarbonisation objectives and help facilitate the European Internal Energy Market (IEM) (DECC, 2013). Britain currently has four interconnectors, with links to France, the Netherlands, Northern Ireland and Ireland. This amounts to 4 GW of capacity, or around 5% of existing generation capacity (National Grid, 2014). There are other projects in the pipeline; if all these connections were constructed capacity would total 11.2 GW, equivalent to 14% of existing capacity and 19% of the UK's 2012 peak demand (DECC, 2013). The UK has a different approach to interconnector development than that of other Member States, with a merchant, or 'for profit' approach preferred (OFGEM, 2013b). This means that independent developers can bring forward projects, paid for through private finance. The more common approach to interconnector development is the 'regulated' model whereby projects are developed by the monopoly TSO and considered as part of the transmission grid. Their income is thus subject to the same regulation as other internal infrastructure, with the project funded by increases to network costs for consumers (Littlechild, 2012).

1.1.2 The Context of the EU

The EU is also strongly in favour of developing interconnection as it is vital to the completion of the Internal Energy Market (IEM) – a project it has been working to realise for over two decades. Beginning in 1996, the EU has introduced a series of Energy Legislative Packages designed to liberalise European energy markets and facilitate the trading and movement of electricity on an EU level, rather than a national level (Jones & Webster, 2006).[4] The trilemma issues of affordability, security of supply and sustainability are also cited as reasons for the importance of developing further interconnection. The EU average electricity price is amongst the highest in the world, with the EC arguing that the development of more interconnection and more connected electricity markets will lead to efficiency gains and competition, resulting in lower prices for consumers (European Council, 2015). Recent disruptions to European gas supply as a result of the recent conflict between Russia and the Ukraine have highlighted an over-reliance on Russian exports (Sharples, 2013). Investment in interconnection will also lead

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[3] See Article 2(1) of Regulation (EC) 714/2009 on conditions for access to the network for cross-border exchanges in electricity

[4] Whilst the Internal Energy Market refers to both gas and electricity, the focus of this paper is on aspects relating to electricity. Whilst the term IEM is used in this paper it refers only to electricity. This is discussed in more detail below in Chapter 1.4.

to security of supply; from a system operation perspective and from a resilience perspective, as it will reduce dependence on gas imports as other generation sources will be available through the interconnected markets (European Commission, 2015c). Furthermore, the EU believes that a more interconnected system will lead to environmental benefits as it will facilitate the integration of more renewable energy sources (ENTSO-E, 2014a).

To help drive interconnection development, the EU has set a target that all Member States should have a level of interconnection at 10% installed electricity generation capacity by 2020 and 15% by 2030 (European Commission, 2015b). There is agreement that interconnector capacity in Europe is currently insufficient (Alexander et al., 2015; DECC, 2013; ENTSO-E, 2014a; Kapff & Pelkmans, 2010). ENTSO-E argues that capacity should double by 2030 to allow for successful market integration and the projected growth in renewable energy generation (ENTSO-E, 2014a). The required investment to upgrade both cross-border interconnection and domestic transmission grids up to 2030 is estimated to cost around €150 billion, with 100 existing or potential bottlenecks highlighted as needing attention (ENTSO-E, 2014a). While generally EU Member States see the benefits of further interconnection, the completion of projects is currently lagging behind what is needed to solve the infrastructural challenges facing the electricity sector (European Commission, 2015c). With interconnectors being large and expensive cross-border projects, they face significant barriers to development, planning and construction. These barriers are due to a range of regulatory, political, economic and supply chain issues (Kapff & Pelkmans, 2010).

As mentioned above, historically electricity systems developed as national in focus with one company known as a utility responsible for the generation, transmission, distribution and retail of electricity. The aforementioned Energy Legislative Packages were thus designed to liberalise markets, create competition in generation and retail and facilitate cross-border trade of electricity (Hancher, 1997). This legislation will be discussed in further detail below. However, the latest legislative intervention will come in the form of Network Codes; a single set of rules to govern the European electricity market. This is a crucial part of the project considering the aforementioned characteristics of national markets and electricity supply (ENTSO-E, 2014a). The Network Codes are regulations, meaning that they are binding and applicable to all Member States once they enter into European law. There are 10 Codes, with 1 in the implementation phase and 9 in the Comitology phase. They are categorised according to whether they impact on 'connection', 'operation' or the 'market'. The three Connection Codes set out the requirements for different users to connect to the transmission grids. The four Operational Codes provide a set of rules and regulations for System Operators, pertaining to the real-time balancing of supply and demand in a secure manner. Finally, the three Market Codes will outline how both electricity and capacity (the availability of transmission networks to transport electricity) can be traded in the IEM (ENTSO-E, n.d.). Despite the fact that the Network Codes were due to be completed by 2014, as of August 2015 only one has entered into force. On 14th August, the Regulation establishing a Guideline on Capacity Allocation and Congestion Management, otherwise known as CACM entered into force having been published in the *Official Journal of the European Union* (OJEU).[5] Previously, the management of congestion and the

[5] Advice from the European Commission's legal service, the Florence Forum, led to a situation where some documents that were developed as Network Codes were instead taken forward as guidelines to speed up the Comitology process. Thus, in 2014, CACM was changed from a Network Code to a Guideline, although importantly it will have the same legal effect. The major difference is that once a Guideline enters into force, only the European Commission can propose amendments, which must then pass through the Comitology Committee. If the Regulation takes the form of a Network Code then *all* interested parties may propose amendments via a process which the association for regulators, ACER, has outlined. The Commission has indicated that there will be provisions for allowing stakeholder input in this process. As ACER considers the amendment process to be of utmost importance, its support for proceeding with CACM as a Guideline is based on the inclusion of the Network Code method of gathering and evaluating amendments (ACER, 2014).

allocation of capacity had been organised at a national level, rather than a European level. It is recognised that a harmonised approach to capacity allocation and congestion management is important for a functioning market, although it may be politically difficult to achieve in practice (Ochoa & van Ackere, 2015; Perez-Arriaga & Olmos, 2005).

1.1.3 Capacity Allocation and Congestion Management

Transmission capacity is needed to transport electricity from generators to consumers. Allocating transmission capacity to users is a vital part of the electricity system. Mäntysaari states that one can distinguish between cross-zonal allocation or intrazonal congestion (2015). In this case, a zone could represent an entire national system (such as the UK grid), or a smaller area inside a national system (such as Sweden, which is split into four zones). Allocating capacity is important in order to prevent congestion. Congestion occurs when there is insufficient transmission capacity to transport the demanded quantity of electricity.[6] In the traditional paradigm of national electricity systems, this may lead to additional lines in areas of need. In the context of the IEM, this could also mean investing in new cross-border interconnection. Overusing transmission infrastructure can lead to expensive, system-wide failures and is thus avoided by system operators (Philipson & Willis, 2006). Traditionally, managing congestion, safely balancing the system and ensuring that there is adequate transmission capacity to meet demand has been the responsibility of TSOs in their respective Member States. With these systems being run by a monopoly, some form of regulation is required to ensure that there is investment in new infrastructure; congestion is generally profitable to TSOs so safeguards are needed to ensure excessive prices don't occur. Joskow argues that having a congested system can lead to impacts on the wholesale price of power, and make it harder to achieve efficient markets (2008). Congestion can also make it harder to maintain system reliability, as well as being expensive, leading to a need for 'redispatching' to balance the system (Joskow, 2008).

With limited capacity in each system, an allocation method is needed to minimise or reduce congestion. Mäntysaari states that allocation methods for scarce capacity can be market-based, through explicit and implicit auctioning, or non market-based through bilateral contracting (Mäntysaari, 2015).[7] These allocation methods are forms of congestion management and aim at preventing congestion or, when it occurs, dealing with it to ensure access whilst keeping the network balanced and secure at the same time (Kruimer, 2014). A certain amount of congestion may be necessary to create price signals, incentivising investment in new capacity and alleviating congestion. Perez-Arriaga and Olmos argue that any plausible approach to congestion management must comply with sound engineering and economic requirements whilst taking into account the diversity of regulatory regimes and market structures in Europe (Perez-Arriaga & Olmos, 2005). Currently, many different mechanisms are used across the EU for the purpose of allocating and pricing scarce congestion resources – something that CACM aims to address through harmonising mechanisms and increasing efficiency (Mäntysaari, 2015; Squicciarini, Cervigni, Perekhodtsev, & Poletti, 2010).

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6 See Article 2(2)(c) of Regulation (EC) 714/2009 "a situation in which an interconnection linking national transmission networks cannot accommodate all physical flows resulting from international trade requested by market participants, because of a lack of capacity of the interconnectors and the/or the transmission systems concerned".

7 Explicit capacity auctions are when transmission capacity is sold separately from electrical energy. Implicit auctioning is when the two commodities are bundled together so that the auctioning of capacity is included in the auctions of electrical energy.

1.2 Problem Definition

As argued above, a wide range of research has shown that developing more interconnection can help both Europe and Britain combat the "trilemma" of energy security, decarbonisation and affordability. Further interconnection of energy markets will have repercussions for both commercial and residential consumers. Furthermore, developing more interconnection between Europe's electricity markets is a key part of the EU's implementation of the Internal Energy Market (IEM).

Recognising that both electricity markets and systems differ throughout Europe, guidelines to harmonise the rules that govern them, in the form of the Network Codes, are vital if a level playing field is to be created and the IEM is to function effectively. However, the UK favours a merchant, for-profit approach to interconnector development which is different to the predominant regulated model in Europe. Thus, the harmonisation of rules is likely to have a differing impact on these two approaches. It is important to understand and evaluate these regimes in the new context of Network Codes to understand what is likely to change and how it may impact on interconnection development.

Whilst there has been attention on the barriers to interconnection development at both an academic and an EU level, the author has found a gap in existing academic research regarding the impact that Network Codes may have on interconnection development. With many of the Codes not yet in the implementation phase, and CACM in the early stages of implementation, ex-ante analysis is important and can provide valuable input for both interconnector developers and policy makers about how to develop strategies for the future that are within the legal context of the new regulation. Furthermore, the research has the potential to add to existing academic literature tracking the progress of the IEM. CACM entered into force on August 14th 2015 – the first to be approved by the European Parliament and the Council. As CACM was the closest to entering into force at the outset of this study, CACM was chosen as the focus, rather than a different Network Code. It seeks to explore the impact that it will have on the merchant approach to interconnector development in the UK and what that may mean for future developments of the Internal Energy Market.

1.3 Objective and Research Questions

The aim of this thesis is to develop an understanding of the impact that the EU Network Code on Capacity Allocation and Congestion Management (CACM) is likely to have on the merchant approach to interconnector development. It also aims to situate CACM in the context of the IEM, assessing what progress it makes towards the realisation of a functioning single market for electricity in the EU. As discussed above, there is little existing academic research on the impacts of CACM on interconnector development. To address this issue, the study will use a legal approach to understand the changes outlined in the CACM regulation. It will situate these changes in the context of the merchant approach to understand how CACM could impact on the business model for interconnection development. It will then look to assess what this will mean for the Internal Energy Market moving forward. In order to achieve the research objective, the following questions will be answered:

1. **What are the different approaches to interconnection development?**
2. **Why does the UK favour a merchant model?**
3. **How will CACM affect the merchant business model for interconnection development?**
4. **How will CACM affect the development of the Internal Energy Market?**

The target audience for this thesis is academics or professionals in the European energy field. It may be of interest to the National Grid and other merchant interconnector developers, as well as other stakeholders in interconnection in the EU. Legal scholars with a focus on EU Regulation may be interested by the perspective offered from an early analysis of CACM. Academics who are interested in the debate surrounding the merits of regulated natural monopoly and competition, or barriers and drivers for interconnector development may also be interested in the case of merchant interconnection.

1.4 Scope and Limitations

In this chapter, the author presents and justifies the scope of the thesis and addresses the limitations of the research. This helps set the boundaries of the research and identify avenues for future research.

The research questions defined above do not mention an assessment of the costs or benefits of interconnection. The author has chosen to rely on the already significant existing literature which analyses the benefits of further interconnection, as outlined in Chapter 1.1. Whilst there are environmental impacts associated with the development of interconnection, particularly that which is subsea, the author takes it for granted that for well-designed projects the benefits outweigh the costs, as has been the approach in a range of literature on the subject. Thus, a comprehensive literature review on the costs and benefits of interconnection will not be undertaken.

The Energy Packages discussed in this thesis include legislation on both gas and electricity. However, with electricity interconnection the focus of this thesis, aspects related to gas are outside of the scope and thus not discussed. Thus, any further reference to the 'Internal Energy Market' is referring to the electricity market. Whilst the term 'Internal Electricity Market' may have been more appropriate, the author has kept to the official EU terminology for the sake of consistency.

Whilst the author is focussing on the impact of CACM on merchant interconnector development, the other Network Codes are also likely to have an impact. This is especially true for the other market Codes; the Forward Capacity Allocation (FCA) and the Electricity Balancing (EB) Codes respectively, as well as the HVDC Connection Code. The author argues that trying to develop a holistic understanding of the impact of these Codes would be an important avenue for further research but was outside of the scope for this thesis due to time and resource restrictions. Indeed, rather than choosing another Code for analysis, CACM was chosen as the focus because when research for this project started, CACM had progressed the furthest in the Comitology process and was thus closest to entering into force. Much of the research and data collection for this thesis was completed whilst CACM was still in Comitology, when it was still unclear as to when it would pass this final stage in the pre-implementation process. CACM was approved in Comitology on July 24^{th}, coming into force 20 days later on August 14^{th} 2015, as stipulated in Article 84. With much of the research designed to be exploratory and ex-ante, there could be critiques that the research is outdated, or void. However, as will be discussed below, CACM often mandates development of certain methodologies, with few Articles requiring actions to be implemented immediately. Rather, entry into force represents the starting of the gun, so to speak, with the designated parties now having a certain time period to develop methodologies for approval by a specified date. Naturally, much of these debates about methodologies had already begun, with the research highlighting developments and tensions surrounding these methodologies. Thus, the author feels that the ex-ante research conducted is still valid as in many cases little has changed, particularly with such a short amount of time for implementation between August 14^{th} and the deadline for this thesis on September

14th 2015. Furthermore, any citations of the draft text of the Regulation have been reviewed to ensure that they are still relevant.

The UK was chosen as the primary focus for investigation, the justification for which is outlined below. Firstly, the merchant approach is used predominantly in the UK. Whilst there have been two other merchant interconnectors built in Europe, they represent the exception rather than the norm. Thus, a focus on the UK is valid as it represents a good case for analysis. Secondly, looking at the case of the UK has allowed for the author to investigate the question of *'why'* – why is there such a difference in attitudes and methods? Answering this question was a vital starting point for this study and reflections on it can help provide insight into why interconnector projects are stalling from a different perspective. As the author is from the UK, access to data was more feasible. This was further facilitated by working with the National Grid. The methodological implications of this association are further discussed in Chapter 2.2. With the author having an association with the National Grid, the decision was taken to anonymise interviewees so that responses could not be traced back to them. All interviewees were informed of this prior to the study and where possible were sent Participant Information Sheets stating the aim of the study and how the information they provided would be used. This is provided in Appendix III.

Whilst it is focused on the UK context, elucidating a better understanding of the 'European' perspective would have been helpful. [8] The author attempted to develop an understanding of the regulated approach through a literature review; however, it is clear that merchant approach has been largely represented in interviews. The author acknowledges that this is a limitation, but felt that limiting the scope to focus on understanding the merchant approach was justified due to temporal limitations. Furthermore, the literature review highlighted that the merchant approach is less understood than the regulated approach, so adding to the literature with this study is justified. However, the author nonetheless acknowledges that more interviews with stakeholders from continental European TSOs or interconnectors would have been beneficial to the study. Furthermore, the author acknowledges that interviewees themselves can represent their own personal or organisational agenda in the information that they choose to disclose, or not disclose. Again, discussions with a range of stakeholders can help to widen the sample and (potentially) limit the opportunity for such bias to form the basis for opinion.

Finally, the interpretations remain those of the author, despite the involvement of National Grid. With much of CACM still to be implemented, these interpretations are of course preliminary. However, the input of industry experts has helped the author gauge the relative import of different aspects and discern patterns. What happens in the future will be interesting to see, with ex-post evaluation of the impacts of both CACM and the wider Codes of importance should the EU wish to overcome the barriers to interconnector development that may hinder the effective functioning of the IEM.

1.5 Disposition

Chapter 2 outlines the research methodology used in this thesis, providing a background on the data collection methods as well as the Multi-Criteria Analysis (MCA) framework used to analyse the merchant approach and the implications of CACM.

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8 Of course, a generalisation of such magnitude is over the top- there is no one size fits all 'European' perspective, particularly with the UK itself being part of Europe and the EU. However, throughout this paper the author will refer to the 'European' approach because it is a convenient way to categorise the different approaches to interconnector development – the UK traditionally favours the merchant whilst "Europe" uses the regulated approach. For a more thorough discussion of this, please see Chapters 4 and 6.

Chapter 3 then presents a literature review on the progress made towards the Internal Energy Market, focusing on the legislation enacted with the aim of furthering its completion. The initial sections discuss the First, Second and Third Energy Packages of legislation enacted in 1996, 2003 and 2009 respectively. These sections include an analysis of the literature, looking at the goals of the legislation and how the Packages have been implemented over time. The author then outlines the key aspects of the Directive and two Regulations contained in the Third Package as this context is more relevant to the understanding of the Network Codes. The more recent TEN-E legislation is introduced, before the chapter concludes with an introduction to the wider Network Codes.

Chapter 4 provides background context to help answer research question 1, outlining the different approaches for interconnector development, presenting the merchant approach and the regulated approach before outlining the differences between the two. It then introduces the new 'cap and floor' regime. This section is also based on a literature review.

Chapter 5 looks in more depth at the focus of this study - the Network Code on Capacity Allocation and Congestion Management. The aims and intent of the Code are outlined, as well as the principles that underline it as defined in the Third Energy Package. Expert interviews highlighted six aspects of CACM that are likely to have an impact on the merchant approach for interconnector development. A legal analysis of the text is categorised according to these six aspects.

Chapter 6 presents an analysis of the merchant approach, analysing its viability as a model for investment in interconnection according to the criteria of legitimacy, effectiveness and efficiency. This section builds on the literature review with interviews, looking to answer research question 2 on the justification for the merchant model, with much of Europe favouring the regulated approach.

These same criteria are then used when discussing the impact of CACM on the merchant approach, which is the focus of Chapter 7. This chapter looks to answer research question 3, building on the work of Chapter 5 to develop an understanding of what CACM may mean for merchant developers moving forward.

Chapter 8 is in two parts. The initial section aims to answer research question 4, presenting a discussion of how CACM could affect the development of interconnection the Internal Energy Market, according to impact on market design and conditions for investment in interconnectors. The second section provides some reflections on the methodology used for research and analysis.

Chapter 9 then presents the main conclusions and findings of the research, suggesting areas for future investigation.

1.6 Ethical Considerations

This study was developed in cooperation with the non-regulated business division of the National Grid, with the author receiving financial support to cover the costs of living over the thesis period. Whilst the topic was suggested to the author as one that would be interesting to the company, all other research, including scoping, data collection and analysis, was undertaken independently by the author. The National Grid did provide the author with some contacts for interviewing, although no further guidance on questions was given. Thus, the author has collected and analysed all data independently. The views shared in this thesis represent those of the author, and not those of the National Grid.

2 Methodology

This chapter provides an introduction to the research approach, methods for data collection and methods for data analysis used in this thesis.

2.1 Research Approach

The focus of this thesis is to develop an understanding of how CACM may impact on the merchant approach to interconnection, as well as how it may impact on progress towards an IEM. The research has been exploratory in nature, justified because CACM does not provide a detailed set of guidelines to be immediately implemented, more a set of requirements of what needs to be developed and by whom, as discussed above. This research is qualitative in nature, including studies of academic literature, EU law and policy documents, supplemented by semi-structured interviews and a two month internship. Working with the National Grid has also allowed the author to make observations, which provide input to both understanding and analysis. The author has tried to remain both objective and critical throughout the research process. The author acknowledges that working with a company can lead to researchers coming into criticism, with accusations of writing for an audience. However, the decision to be involved with the company has allowed for collaboration and access to stakeholders that benefited the study and ultimately made it possible. Dalhammar cites Hakim, who suggests that policy-oriented research will summarise current knowledge in a field and examine the knowledge and practice of relevant stakeholders, in order to discuss the background and consequences of policy (Dalhammar, 2007; Hakim, 2000). Whilst a literature review has allowed me to complete the first aspect, working with National Grid has helped facilitate some access to expert stakeholders to discuss the consequences of the intervention that is the focus of this thesis. The research has relied on triangulation, defined as the use of various data sources and methods to examine a specific phenomenon to increase confidence in the conclusions (Dalhammar, 2007). This is displayed in Figure 2, below. This allows for a wider understanding and a more comprehensive picture, as opposed to an analysis from the perspective of a singular discipline. The methods for data collection and analysis that form the basis for this triangulation will be discussed below.

2.2 Methods for Data Collection

The following section covers how data was collected in this research. Alongside the methods mentioned, the author also gained understanding through working with the National Grid in office during June and July 2015. These methods are summarised below in the research design shown in Figure 2. The blue boxes represent the main focus, with the white boxes the sub-foci that can be related to the research questions. The arrows designate chronology of the work flow, with the right hand arrows indicating an iterative process; the reading of CACM informed the interviews and vice-versa.

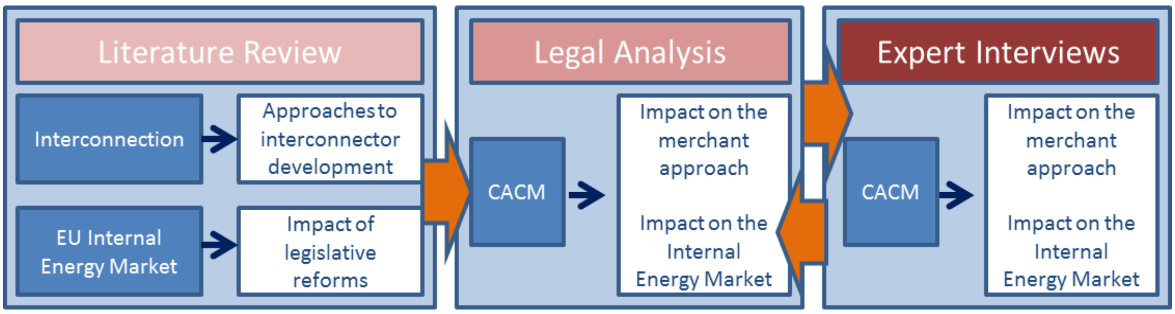

Figure 2: Research design

2.2.1 Literature Review

A literature review was required to develop an understanding of the wider contexts of the electricity sector, interconnection and EU interventions into energy markets. This study uses a number of sources of data, including current and former European legislation; European case-law and Decisions; policy documents; consultation documents from both the British energy regulator, OFGEM, and ENTSO-E; consultant reports; and both legal and non-legal academic literature.[9] Using data from a wide range of sources is seen as an important part of triangulation (Hakim, 2000). Reviewing this literature provided a better understanding of the context surrounding interconnection and its relationship with the Internal Energy Market. This has allowed for a lens through which to understand the primary focus of analysis; CACM.

2.2.2 Legal Approach

As the primary focus of this thesis is a legal text in the form of an EU Regulation, a legal approach to analysis is justified. A traditional legal analysis looks at the semantics and wording of the text, drawing on important cases and precedents, allowing practitioners to understand how to interpret the law (Ronay, 2014). The fact that CACM has only recently entered into force means that there are no precedents that directly relate to it. Thus, it was even more important to situate CACM in the context of prior EU interventions, as exemplified by Chapter 3 which provides a literature review on the IEM. Further to the literature review, analysis of prior EU legal decisions, EU case law and Opinions of the European Commission have been used to justify assertions where necessary. The unique nature of CACM provided further justification for the use of interviews, allowing for feedback on the author's interpretation from expert stakeholders as indicated in Figure 2, above. This is discussed below in Chapter 2.2.3. This approach has allowed for the author to develop a picture of the EU view on merchant interconnection, which has informed the analysis of CACM. In this thesis the author often cites Recitals. The author acknowledges Baratta's assertion that these are interpretive tools used to give context to the legislation and not legally binding in European Courts, but argues that they remain a valuable source of information with this caveat in mind (2014). A list of all legislation cited in this study can be found in the Bibliography.

2.2.3 Interviews

Primary data was collected through expert interviews with a range of stakeholders. Interviews were selected as a method for data collection because they allowed the author to gather information to supplement the literature review and the reading of CACM. This is important because of the aforementioned lack of academic writing on CACM. As this research is exploratory in nature semi-structured interviews was deemed suitable in order to obtain relevant, qualitative data (Brinkmann & Kvale, 2015). Semi-structured interviews allowed for a level of spontaneity, whilst providing a certain amount of structure to guide the process. During the interviews, the author used open ended questions to develop an understanding of the interviewee's opinions on the impacts of CACM. The interviewee was then presented with the authors findings for input and comment. This allowed the author to both test assumptions whilst also develop new ideas; a part of the exploratory approach discussed in Chapter 2.1. A total of 11 interviews were conducted, both in person and over the phone, between June and August 2015. The interviewees were selected based on their status as 'experts' in their respective fields. With interconnection a 'niche' field there is a limited pool of professionals that specialise in the areas of interest to this study. Thus, any form of random sampling was discounted. The author acknowledges the inherent bias in such a selection method, but argues that it is justified

[9] Note that whilst this paper refers to the context of the UK, OFGEM are only the regulatory authority for Great Britain, including England, Scotland and Wales. Northern Ireland has a separate regulator, the Utility Regulator.

in light of the difficulties associated with finding relevant people to interview. Furthermore, efforts were made to interview stakeholders from a range of backgrounds, with interconnector developers, System Operators, Government and the national energy regulator all represented. A documentation of the date and method of interview, as well as the organisation for which the interviewee (or interviewees, in some cases) worked is listed in Appendix I. Prior to undertaking interviews, it was decided that the interviewees would remain anonymous. Further to this, interviewees were given the option to redact any information should they feel it to be commercially sensitive. This approach was justified as it led to the participation of a wider range of stakeholders. An example of the Participation Information Sheet is provided in Appendix III.

2.3 Methods for Data Analysis

This section outlines the methods used for data analysis. An initial assessment of a range of approaches is presented. For the analysis, a legal approach to data collection and analysis was used to develop an understanding of the implications of CACM on the merchant approach to interconnector development. This has been discussed above in Chapter 2.2.2. Further to this, an analysis of CACM as an intervention was undertaken using a Multi-Criteria Analysis.

2.3.1 An Assessment of Alternative Approaches

A number of methodological approaches were considered by the author. As CACM had not entered into force at the start of this study, an ex-ante impact assessment was considered. The EU have developed a methodology for such analysis which it sees as a tool to help decision-makers, from European Commissioners, to Members of the European Parliament, to Ministers (IMPA, 2015). This ex-ante impact assessment should "map out potential impacts in an integrated and balanced way across their social, economic and environmental dimensions, and, where possible, their potential short and long-term costs and benefits, including regulatory and budgetary implications" (European Parliament, 2012, p. 2). The Annex of the guidance document lists seven key components for an impact assessment, broken down into several sub-components. The resources required to complete an assessment of all components were deemed too great to be within the scope of a Masters thesis. However, these components provided useful food for thought that influenced the thesis going forward. Component 2, 'Definition of the Problem', requires answers to the following questions:

- What is the issue or problem which is likely to give rise to action?
- What are the reasons underlying the issue or problem?
- Who is concerned by the problem, how and to what extent?
- How may the problem develop in the light of the action taken or planned by the Union, the Member States or other parties involved?
- Is Union action justifiable in the light of the principles of specificity (legal basis in the Treaties), subsidiarity and proportionality?

It is certainly pertinent to raise these questions when thinking about CACM as a regulatory intervention, something that the author takes forward in the wider thesis, particularly Chapters 6 and 7.

Scenario development was also considered, whereby the author would hypothesise about a range of 'futures' for interconnection development in which the impact of CACM was considered as a factor. Van Notten defines these scenarios as "consistent and coherent descriptions of alternative hypothetical futures that reflect different perspectives on past, present, and future developments, which can serve as a basis for action" (Van Notten, 2006, p. 2). These scenarios would be informed by a range of factors that have the potential to impact on interconnection development, such as power prices, the cost of materials and regulatory decisions. However, this would result in less of a focus on the impact of CACM itself and result in a wider study of how interconnection might look due to myriad factors. Whilst such a study would be interesting, the author felt that it was just as relevant to keep the scope limited to the impact of CACM, rather than broaden it. Furthermore, whilst not required for all studies, scenario development often requires quantitative inputs to allow for modelling to lead to measurable outputs (De Jouvenel, 2000). Whilst of interest, modelling capabilities are beyond that of the author. A cost-benefit analysis (CBA) was discounted for similar reasons.

2.3.2 Multi-Criteria Analysis

Multi-criteria policy analysis (MCA) was chosen to allow for the evaluation of a) the suitability of the merchant approach to achieving interconnector development in the UK, and b) the impact that CACM may have on this approach. Vedung defines evaluation as the assessment of the merit and effect of ongoing or finished government intervention which aims to play a role in a future situation (Vedung, 2013). With that in mind, multi-criteria policy analysis allows for the user to evaluate, either ex-ante or ex-post, the impact or success of a policy or regulation depending on a range of criteria (Mickwitz, 2003). Alongside the aforementioned resource-related limitations, the author argues that it is the flexibility of this method for analysis that makes MCA more suitable for this study than the other methods, such as CBA and ex-ante impact assessment.

Mickwitz categorises eleven evaluation criteria according to whether they are general, economic or democracy-related (2003). These criteria are outlined below in Table 1.

Table 1: Evaluation Criteria for Policy Instruments

General	Economic	Democracy
Relevance	Efficiency (Cost-benefit)	Legitimacy
Impact	Efficiency (Cost-effectiveness)	Transparency
Effectiveness		Equity
Persistence		
Flexibility		
Predictability		

Source: Mickwitz, (2003)

The criteria to be used in this study have been chosen based on a literature review and available data. The criteria allow for the analysis of the current context of the merchant model, whilst also providing a framework for understanding, structuring and categorising the impacts of CACM on that model. They will thus help to answer RQ 2 and 3. The author considered using a range of criteria from each of the categories, but scoped down the eleven criteria discussed by Mickwitz to three. The considered criteria are discussed, before the chosen criteria are summarised below. *Relevance* was considered as a criterion as it investigates the goals of the intervention, and whether thet cover the key issues that it aims to address. Whilst this criteria is valuable, the author felt that the relevance of the merchant model could be covered equally well through looking at *effectiveness*. The cost-benefit *efficiency* criterion was deemed to require too much quantitative input, as has been outlined above. *Equity*, which looks at the distributional effects of the intervention, was initially chosen as a criterion for investigation. However, the author deemed it to be unnecessary as the relevant information could be categorised according to the other three criteria. Further discussion on the selection of criteria, and the reasoning for removing *equity*, can be found in the Methodological Discussion in Chapter 8.2.2. The below paragraphs will outline the three criteria chosen.

Legitimacy looks at how accepted the merchant approach is, focussing on the UK context and the European viewpoint. This acceptance impacts on its feasibility, with a lack of feasibility presenting a barrier to development that may help to explain the aforementioned lack of development of interconnectors. The legitimacy is assessed in a qualitative manner, with feasibility assessed in the eyes of the British National Regulatory Authority (NRA), OFGEM, and the EU. OFGEM are the independent organisation responsible for the rules and regulations that govern the UK energy market, with the aim of maximising the welfare of UK consumers. According to Mickwitz, legitimacy "can be a question of the specific institutions involved, the implementation procedure and the outputs and outcomes generated" (2003, p. 428). To go through these criteria, an analysis of the development process for the Network Codes has recently been completed by Jevnaker and shall not be repeated here (2015). Further to this, with CACM recently having begun the implementation stage, an investigation into the success of implementation itself would be premature. Thus, the author argues that focussing the scope to investigating legitimacy from an institutional perspective is justified. Chapter 6 will focus on the current legitimacy of the merchant approach, whilst the Chapter 7 will investigate what CACM may mean for this approach moving forward.

Effectiveness looks at whether the outcomes (or projected outcomes, in this case) correspond to the goals of the intervention; achieving more interconnection. In Chapter 6, the effectiveness of the merchant approach in the UK is ascertained through looking at both the number of existing interconnectors, and the number of interconnectors in the pipeline. The context surrounding this development helps to provide a better understanding of the effectiveness, rather than purely basing the evaluation on the numbers. Chapter 7 provides analysis on how CACM may impact on the effectiveness of the merchant approach in the future, building on the analysis of CACM in Chapter 5 to hypothesise about the impact on the business case for merchant interconnectors.

Efficiency, in terms of cost effectiveness, looks at who bears the cost of the policy and whether it could have been achieved with fewer resources. As Mickwitz notes, using economic evaluation criteria is problematic because it can be hard to develop accurate costs and benefits, and find accurate data (2003). Furthermore, a full economic assessment of the cost-effectiveness of CACM in the form of a CBA would be too time consuming to be achievable and thus, as discussed above, is outside the scope of this study. However, cost effectiveness is an important factor when evaluating the most suitable model for interconnection development. Thus, an analysis of the merchant model in terms of economic efficiency is valuable, even if it is qualitative rather than quantitative. This section brings in literature on theories of natural monopoly to help provide another lens through which to understand both the current context and the prospective context of the business case under CACM.

3 The Internal Energy Market

It is important to situate CACM in the context of previous EU legislation, enacted with the aim of achieving an Internal Energy Market (IEM). In chronological order, this chapter presents an overview of legislation that has been enacted with the aim of completing the IEM and increasing cross-border flows of electricity through interconnection. The author provides a review of literature on the progress made towards liberalisation of markets in the First and Second Packages, as well as a review of the text of the Third Package. It then introduces the TEN-E regulation before finishing with a section on the Network Codes. Overall, it finds that whilst initial legislation was enacted with the aim of liberalising markets and breaking up national monopolies, later legislation has seen an increased focus on the development of infrastructure and a more concrete market design. Generally, progress towards liberalisation has been slow, initially hampered by the lack of legislative power and resistance from Member States with powerful incumbent utilities. However, the development of new pan-European organisations and harmonised rules may speed up the implementation of the IEM.

3.1 Electricity Markets in Europe

Until the 1980's electricity markets were traditionally non-competitive, with vertically integrated firms responsible for generation and transmission and a retailer operating with a monopoly on supply to the market (Philipson & Willis, 2006). In many countries, such as Britain, this was state owned and operated. The company, or utility, was overseen by a national or regional regulator, who monitored or set prices in order to restrict the ability of the monopoly to abuse its position in the market and ensure that investment in infrastructure was adequate (Hancher & de Hauteclocque, 2010). Initially, this organisation was designed to allow for the successful development of the electricity system; granting a monopoly was a trade off in return for assurances that all would receive access to electricity, even rural consumers who it was not profitable to supply (Philipson & Willis, 2006). In the 1980s and 90s, some countries began to liberalise markets, breaking up the monopolies and opening generation and retail markets up to competition in an attempt to increase service standards, improve efficiency and lower prices (Joskow, 2008). Whilst the move from a regulated, central planning approach to a market-based approach by countries such as the UK, the USA and Sweden represented a departure from the status quo, governments still retained an ability to influence and the electricity system was still seen as a sovereign issue. This began to change further in the 1990's, when the EU began to legislate on the creation of an internal market, enforcing similar liberalisation in Member States as had been enacted in countries such as the UK. However, this was a difficult and lengthy process, with Member States keen to retain the power to organise their markets how they saw fit, as will be elucidated below. Howarth and Sadeh note that there has been "been persistent domestic political opposition to privatization and liberalization, with strong trade-union, party-political and public hostility – encouraged by the fear that gas and electricity prices would rise after liberalization" (2010, p. 927). However, with Member States often having relatively similar electricity market architectures, the EU argued that there were many benefits to be had from improving integration and making better use of existing grid infrastructure, as well as developing competition and improving efficiency (Meeus, Purchala, & Belmans, 2005).

3.1.1 Why an Internal Market?

With the liberalisation process outlined in the legislation discussed below, the EU aims to create a single IEM. The EU believes that a liberalised, harmonised internal market for energy will bring a range of benefits to Member States. Their stance on breaking up monopolies, promoting competition and developing connected systems is in line with the Treaty on the Functioning of the European Union (TFEU), which has articles concerning the free movement of goods and services, competition, public monopolies and undertakings entrusted with services in the general economic interest (Talus, 2013). They believe that having a larger, single market as opposed to weakly integrated or separate national markets will lead to social welfare gains and higher standards for consumers across the EU through improving efficiency and increasing competition in generation and retail (Kessel, Meeus, & Schwedler, 2011). Whilst the EU and pan-European bodies such as ACER and ENTSO-E often refer to 'social welfare' (see, for example, ENTSO-E, 2014a), the author could not find a clear definition of the term in documentation from these sources. Thus, based on the context that surrounds their repeated use of the term, the author assumes that the EU defines social welfare in relation to neo-classical economic theory, whereby total benefits to society are netted against the total costs as a result of a transaction (Goodwin, Harris, Nelson, Roach, & Torras, 2015). In this case, 'society' represents all European citizens. Thus, a transaction or allocation of resources can be seen as having a benefit to social welfare if it reduces the average cost to European citizens. The EU believes that having a single IEM will improve social welfare, as prices in previously separate national markets start to converge to one 'European' price for electricity. Crucially, improving social welfare does not account for the distribution of the benefits. Whilst a country with higher electricity prices will be happy to see prices reduce to a lower price, a country with lower prices may be less happy as prices begin to increase thanks to the linking of markets. In the latter case, with more competition for the lower priced electricity, demand for the generation will rise, increasing the price over time. However, in the eyes of the EU, 'social welfare' will have increased because they feel that the average price for electricity across European Member States as a whole will drop as a result of this competition. In reality, the distributional effects of market coupling can understandably create tensions between Member States, even if the benefits to security of supply are mutual. Whilst it is outside the scope of this thesis, a more comprehensive discussion on the economics of interconnectors can be found in the seminal paper by Turvey (2006), whilst an analysis of the winners and losers of market coupling can be found in a recent paper by Ochoa and van Ackere (2015). Further to these economic benefits, the relatively recent rise of intermittent renewable generation and supply disruptions caused by Russia has pushed environmental and security of supply issues up the agenda, adding impetus to the drive for the IEM (Huhta, Kroeger, Oyewunmi, & Eiamchamroonlarp, 2014). However, with powerful incumbent utilities and a range of national agendas for Member States across Europe, the challenge of developing a single, internal market cannot be overstated, particularly when it must be aligned with other policy objectives and market mechanisms.

3.1.2 The Background to the Development of the IEM

Many academics argue that the turning point for the development of common European energy policy, the liberalisation of markets and an IEM was the adoption of the Single European Act (SEA) in 1987 (Hancher & de Hauteclocque, 2010; Kruimer, 2014). The SEA, arguably one of the most significant pieces of EU legislation, resulted in the goal of a competitive single market by 1992. Key to the achievement of the internal market was the reform of the legislative process for adopting binding secondary legislation such as Directives and Regulations. The move to install a majority voting system, rather than a unanimous system, meant that it was easier for the European Parliament and the Council to adopt new legislation (Kruimer, 2014). Whilst the legislative reforms were important, Kruimer cites a Working Document on the internal energy market, published by the Commission of the European Communities in 1988 as "the first step towards the liberalisation of energy markets" (2014, p. 24). The Working Paper recommended the application of four sets of legal instruments to the energy sector: the rules of free movement of goods, state monopolies (with exclusive rights), competition and state aid. Kruimer notes that applying these rules to national energy markets was concluded to be a difficult task due to the structure of energy markets – national in focus with limited cross-border integration and few or one supplier(s) who were generally highly supported or state-owned (2014). This is further discussed below.

3.1.3 The Legal Basis for Energy Legislation

At this point it is important to mention the legal basis for energy in the context of the EU. Despite the importance of the energy sector, a common policy for energy was not part of the initial Treaty of Rome in 1957. It was not until 50 years later, when the Treaty of Lisbon entered into force in 2009, that the Union moved to legislate over energy as one of its shared competencies (Hancher & Salerno, 2012; Wylie, Winand, & Marc, 2011). Prior that that point, while there was legislation that related to energy (including the First and Second Packages discussed below) EU energy policy operated without an express legal basis in the Treaty (Krämer, 2003). It has been argued that the lack of a definitive legal basis for energy policy lead to the absence of an EU energy regulator that could take charge of the regulatory landscape surrounding interconnector development (Hancher & de Hauteclocque, 2010). Since 2009 when the Treaty of Lisbon entered into force, Article 194 of the Treaty on the Functioning of the European Union (TFEU) has provided the legal basis for further energy legislation. This gave the European Commission the power to alter property rights in Member States and enforce the unbundling of utilities, delivering further progress in the push for the IEM (Hancher & de Hauteclocque, 2010). This was much needed, as according to Howarth and Sadah "transgression in transposition of Directives is greatest in financial services, *energy* and transport markets" (2010, p. 924, emphasis added). The Lisbon Treaty allows the EU to impose penalty payments upon Member States for late transposition of directives, incentivising compliance. However, the use of such methods may be counterproductive, with further support to help Member States with their legal obligations more likely. Article 194 TFEU defines the goals of EU energy policy. According to Article 194 (1), EU energy policy should, whilst considering the protection of the environment, aim to: ensure the functioning of the energy market, ensure security of energy supply in the European market; promote energy efficiency and energy saving; promote the development of new and renewable forms of energy; and promote the interconnection of energy networks (Krämer, 2011). It is perhaps noteworthy that in the 2003 volume of his work on EU Environmental Law, Krämer states that there are three goals of community energy policy as opposed to the five listed above. These were to ensure security of supply, improve competitiveness and ensure quality of life of citizens whilst accounting for the protection of the environment (2003). The changing context, which sees the new expression of the importance of both renewable generation and interconnection, is important to note in the context of this study. To conclude, Hancher and Salerno argue that the lack of a clear legal basis for energy legislation hampered the market reform process, whilst Green and Newbery argue that it meant that the EC lacked the power to enact an aggressive policy of horizontal de-integration which would probably have delivered better and faster results (Green & Newbery, 1997; Hancher & Salerno, 2012).

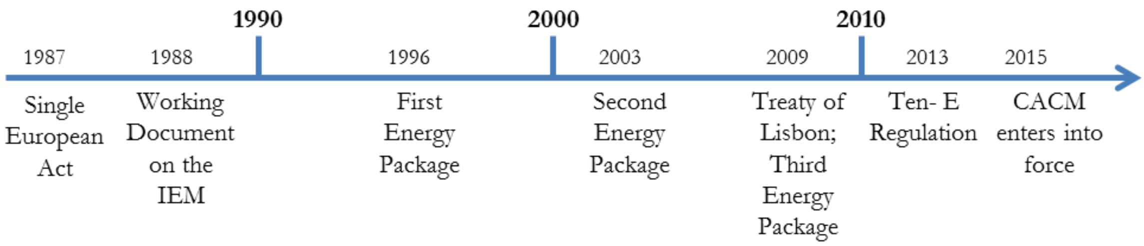

Figure 3: A timeline of important developments in the history of the IEM

3.2 The First Energy Package

This section begins the literature review on the three legislative Packages introduced by the EU, as outlined in Figure 3, above. Hancher states that the differing views of Member States regarding the organisation of the new internal market made it difficult to achieve consensus, resulting in a lengthy ten year negotiation process that led up to the First Energy Package (1997). Following the Single European Act and the new legislative process discussed in Chapter 3.1.3, the EU began to legislate on energy markets with the First Energy Package in 1996, in the form of Directive 96/92/EC.[10] This aimed to break the dominant structure of national monopolies and poorly connected grids, liberalising markets and introducing competition – the first steps towards the redefining of energy markets in Europe. Kruimer defines liberalisation as "the gradual process of removing trade restrictions on the movements of goods, services and capital in the national energy markets, and opening these markets up to competition" (2014, p. 24). The Directive outlined the conditions that should be in place to assure the creation of an Internal Electricity Market without providing a concrete design for the market itself (Meeus et al., 2005). Jones and Webster argue that six aspects need to be in place to allow for the successful development of an internal market for electricity (2006):

1. Creation of a competitive market for electricity
2. Allow for Third Party Access (TPA) to transmission and distribution networks
3. Unbundling of the traditional 'utility' structure
4. Establishment of an independent energy regulator
5. Ensure high public service standards
6. Develop effective EU-wide rules on trade and regulatory issues

Whilst a full analysis of each Energy Package is outside the scope of this study, the author will reflect upon the developments towards these six aspects in the following sections. Furthermore, not all aspects were covered in all Directives, as will be summarised in Table 2 in Chapter 3.3.

Directive 96/92/EC began the process of opening national markets to competition and aimed to enshrine the freedom to export and import electricity (free movement of goods) alongside the right to establish a generation company in any EU country (free establishment) (Jones & Webster, 2006). The First Package introduced regimes to open up transmission and distribution networks to Third Parties, more commonly known as Third Party Access regimes (TPA). New entrants to the generation market needed assurances that they could access the grid network so that they could negotiate and settle contracts to deliver electrical power (Meeus et al., 2005). In theory, vertically integrated utilities that enjoyed a monopoly on both generation and transmission would have no incentive to open up access to these new generators as the competition may lead to lower prices and a smaller market share (Kruimer, 2014). To account for such conflicts of interest the First Package introduced an 'unbundling' regime. Unbundling is the term given to the separation of vertically integrated companies, breaking up generation, transmission, distribution and retail into separate operations, meaning that they cannot be undertaken by one singular integrated company. This aimed to eliminate the monopoly power enjoyed by incumbent utilities that allowed them to control markets and remove the aforementioned conflict of interest. The first Directive required what was known as an 'administrative unbundling' of utility activities, only obliging incumbent vertically integrated companies to present a separate balance sheet for generation, transmission, distribution and retail (van Koten & Ortmann, 2008).

The first Directive also broke the monopoly over supply, creating the concept of 'eligible consumers'; users of large amounts of electricity who had the legal capacity to contract volumes from any supplier (Meeus et al., 2005). Jones and Webster argue that the original Directive, adopted in 1996, can now clearly be seen as the first important step in the creation of a Europe-

[10] Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity. It was enacted along with 98/30/EC, which related to the Internal Market for Gas. As mentioned above, this is outside the scope of this paper.

wide competitive electricity market (2006). However, progress was limited – unbundling was not implemented effectively and an independent energy regulator was not appointed (Jones & Webster, 2006). Furthermore, Hancher argues that the framework nature of the Directive led to differing models of liberalised markets across Member States, coupled with differing degrees of supervisory intensity by national regulators over whose policies and actions the Commission had little direct control (Hancher, 2000). Apart from the imposition of certain duties on TSOs, the First Package did not provide much guidance on the issue of cross-border trade or capacity allocation and congestion management; a key aspect of this paper. Hancher states that neither the scope, content nor nature of TSO duties is harmonised or even co-ordinated (2000). In light of the discussions above, the weak unbundling regime represented the most pragmatic option for the EU, who at the time had less legislative power in the energy sector than today. Thus, whilst the First Package was an important step, much work was needed to speed up and strengthen implementation to help break up integrated utilities and introduce competition.

3.3 The Second Energy Package

The First Directive was replaced in 2003 by Directive 2003/54/EC concerning common rules for the internal market in electricity and supplemented by Regulation 1228/2003/EC on conditions for access to the network for cross-border exchanges in electricity; also known as the Second Energy Package (Kruimer, 2014). Meeus et al. argue that the First Directive was implemented into national legislation using different approaches and at different paces. (2005). The Second Directive, however, can be characterised by shorter deadlines and less freedom regarding implementation (Meeus et al. 2005). An example of this is given by Jones and Webster, who state that in the initial directive, Member States could choose between two methods of liberalisation; an authorisation procedure or a tendering procedure. The Second Directive legislated that an authorisation procedure should be the normal manner for permitting the licensing of new generation capacity. This was significant as it removed the ability for Member States to centrally plan their energy system, leaving it to the market to match demand and supply; a fundamental change from the previous system and the tender-based method (Jones & Webster, 2006). This is seen as a key facet of the IEM, with market forces the preferred driver for developments in supply rather than state intervention (Huhta et al., 2014).

Furthermore, the Second Directive goes a step further than the First Directive as it required legal or operational unbundling for transmission and distribution companies by July 1, 2007 (Meeus et al., 2005). Legal unbundling meant that transmission and generation companies were required to be separate legal entities, whilst ownership unbundling mandates that generation and transmission have to be owned by independent entities and that these entities cannot hold shares in both activities (van Koten & Ortmann, 2008). This was further separation than was mandated under the First Directive, with the administrative unbundling regime seen to be insufficient. Furthermore, Meeus et al. note that implementation of the unbundling was slow, with eight Member States receiving warning from the EC; whilst van Koten & Ortmann further posit that the unbundling was not completed in the form that would be the most welfare-enhancing (2005; 2008). They argue that as EU allows its Member States the choice of an unbundling regime (legal or ownership) and the time path of implementation (quick or slow), many Member States chose the legal implementation as it left more room for corrupt politicians to grant incumbent utilities higher rents, suggesting "that the choice EU law provides – a choice not suggested by economic theory – might be the result of a legislative process that has been compromised through questionable means of persuasion" (van Koten & Ortmann, 2008, p. 3139).

The new Directive aimed to further develop the concept of 'eligible consumers', with all non-residential customers deemed eligible to contract electricity from any supplier from July 1st 2004 and all residential customers three years later on July 1st 2007 (Meeus et al., 2005). Despite such provisions, on the implementation of liberalisation, Moselle argues that whilst some Member

States, such as the UK and the Scandinavian countries succeeded in developing effective competition in both wholesale and retail markets, generally progress towards liberalisation in the EU was limited. Most markets remained national in scope and dominated by the incumbent utilities that the prior legislation was aiming to unbundle (Moselle, 2008).

Perez-Arriaga & Olmos argue that despite the strong academic focus on the issue of congestion management in transmission systems, the subject cannot be considered as closed, especially in the context of the IEM, where there are currently a range of regulatory regimes and market architectures across Member States (2005). Differing congestion management schemes can present a barrier to the free movement of electricity; a significant obstacle to the completion of the IEM. Karova states that rather than include provisions in the updated Directive of the Second Package, the EU began to legislate on congestion management with a separate Regulation – the aforementioned 1228/2003/EC (2011). Article 6 provided 'General Principles of Congestion Management', with the Annex outlining Guidelines on the management and allocation of available transfer capacity of interconnections between national systems, also known as Congestion Management Guidelines (CMGs). These Principles are discussed in further detail in relation to CACM in Chapter 5.3. Overall, Karova states that the Regulation and its Annex aimed "to set fair rules for cross border exchanges in electricity within the IEM, including a compensation mechanism for cross-border transit flows of electricity, harmonized principles for network access charges and rules for allocation of available capacities of interconnections between national transmission systems" (2011, p. 84). Regulation 1228/2003 provided some principles and mechanisms to facilitate the cross-border transit of electricity, including transmission charges and allocation of available capacities. However, Boucher and Smeers believed that these principles were unlikely to be sufficient to bring about a single market (as was argued by the EC) and needed to be accompanied by 'harder measures' that would lead to a full market design (2002).

To summarise, the Second Package introduced a stricter unbundling regime and aimed to speed up the liberalisation of markets. It also began to legislate on the issue of cross-border trade. However, without a legal basis for energy, progress remained slow and implementation was piecemeal. Before a single market could even be developed, the playing field needed to be level; this was far from the case. This created the need for further legislative reforms, as discussed below. Progress made by the Packages in relation to the aforementioned criteria noted by Jones Webster as vital for a successful IEM is summarised below in Table 2.

Table 2: Progress towards the criteria outlined by Jones and Webster (2006) as needed for a successful IEM

Criteria	First Package	Second Package	Third Package
Creation of a competitive market for electricity		x	
Allow for Third Party Access (TPA) to transmission and distribution networks	x		
Unbundling of the traditional 'utility' structure	x administrative	x legal/ownership	x ownership/ ISO/ITO
Establishment of an independent energy regulator			x
Ensure high public service standards			x
Develop effective EU-wide rules on trade and regulatory issues			x

Source; Authors own, based on literature

3.4 The Third Energy Package

The aim of this legislative package was to introduce new Europe-wide concepts on consumer rights, mandate stricter unbundling regimes, create new pan-European organisations and instigate the development of new Network Codes that would facilitate the harmonisation of energy markets in Europe with the aim of completing the IEM. Third Energy Package repealed Directive 2003/54/EC and Regulation (EC) No 1228/2003, replacing them with Directives 2009/72/EC and Regulations (EC) 713/2009 and 714/2009.

3.4.1 Directive 2009/72/EC

The Third Package, whilst recognising that the previous packages had made progress, acknowledges that "there are obstacles to the sale of electricity on equal terms and without discrimination or disadvantages in the Community. In particular, non-discriminatory network access and an equally effective level of regulatory supervision in each Member State do not yet exist".[11] The Third Package thus aims to strengthen and increase the importance of independent National Regulatory Authorities (NRAs) who are responsible for overseeing liberalisation, fairness and consumer rights. The Directive alludes to the importance of interconnection much earlier in the Preamble than the previous versions. This represents a change in intent from the prior legislative Packages, which began the task of liberalising markets and introducing competition. It notes that cross-border interconnection should be further developed in order to secure the supply of all energy sources at the most competitive prices to consumers and industry within the Community, and to allow for the implementation of a sustainable climate change policy.[12] This change in intent is significant. As Squicciarini comments, the 1996 Directive initiated two streams of reform: one at Member States level, for the implementation of national wholesale electricity markets; another one, at European level, aiming at the integration of national markets into a single European market (2010). The two streams progressed independently and each at a different pace.

This Directive:

> "establishes common rules for the generation, transmission, distribution and supply of electricity, together with consumer protection provisions, with a view to improving and integrating competitive electricity markets in the Community. It lays down the rules relating to the organisation and functioning of the electricity sector, open access to the market, the criteria and procedures applicable to calls for tenders and the granting of authorisations and the operation of systems. It also lays down universal service obligations and the rights of electricity consumers and clarifies competition requirements".[13]

Thus, the third Directive is focussed on both market activities and consumers. It outlines that generation and retail should be open to competition, but also that the consumer should have the ability to select their retailer – something not available in all Member States. The Directive is interesting in that it moves to strengthen the requirements in terms of service provision for customers. Whilst the First Directive merely introduced that customers should be free to choose from a range of suppliers, the Third Directive begins to introduce "common minimum standards" for service provision. Whilst there are provisions contained elsewhere in the Directive, Annex I outlines a range of "Measures on Consumer Protection". One aspect is the

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[11] Preamble 4, Directive 2009/72/EC

[12] Preamble 5, Directive 2009/72/EC

[13] Article 1, Directive 2009/72/ EC

recognition that it is important that "vulnerable" consumers should benefit from competition and fair prices. Key to this is having access to price and usage data so that they can compare between suppliers. It is argued that "information on energy costs provided to consumers frequently enough will create incentives for energy savings because it will give customers direct feedback on the effects of investment in energy efficiency and change of behaviour".[14] Key to this is the roll out of smart meters in the EU, which is also mandated by this Directive.[15]

Furthermore, the Directive notes that "the rules on legal and functional unbundling as provided for in Directive 2003/54/EC have not led to effective unbundling of transmission system operators".[16] Thus, it continues to develop and strengthen the unbundling regime, requiring ownership unbundling (defined in Chapter 3.3.2) as a minimum, but with the option of the Independent System Operator (ISO) or the Independent Transmission Operator (ITO) models.[17] The second model allows for TSOs to keep transmission assets on their balance sheets whilst the ITO model allows for the possibility to keep all activities within one vertically integrated company, under intense supervision from both an NRA and the EC (Kruimer, 2014). Platts notes that the unbundling regime was so controversial that the final compromise allowed national governments to choose from the different models, with the ITO model representing a compromise (Platts, 2013). Nowak notes that although progress has been made since 2004 and the Second Package, only ownership unbundling of the TSOs seems to have the capacity to further improve third party access to networks and allow for the equal, non-discriminatory access needed to allow for a competitive IEM (2010). The progress towards this is ongoing, with one country choosing the ISO model, five choosing the ITO model (including France and Germany) and 17 choosing operational unbundling (Platts, 2013). The implications of this unbundling for competition on the IEM, if and when it enters operation, will be under close scrutiny of both NRAs and ACER, who are introduced below.

3.4.2 Regulation (EC) 713/2009

This regulation is significant because it establishes the Agency for the Cooperation of Energy Regulators (ACER). ACER is a "Community body with legal status" whose purpose is to coordinate between the different NRAs (such as OFGEM in Britain) with the aim of working towards the completion of the IEM for both electricity and gas.[18] ACER is composed of permanent staff and experts, seconded by NRAs from EU Member States in the field of energy. The Agency's regulatory activities are overseen by a Board of Regulators, composed of senior representatives of the NRAs for energy of the 28 Member States (ACER, n.d.). Hancher and de Hautecloque state that whilst cooperation between regulators in the EU had been previously established, initially through the formation of CEER in 2000 and then ERGEG in 2003, the lack of formal enforcement powers held by these organisations meant that they had no real institutional ability to act (Hancher & de Hauteclocque, 2010).[19] Thus, ACER represents an attempt to strengthen ex-ante regulation in the EU, with the goal of further empowering NRAs

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14 Recital 50, Directive 2009/72/ EC

15 Annex I, Article 2 of Directive 2009/72/ EC states that "where roll-out of smart meters is assessed positively, at least 80 % of consumers shall be equipped with intelligent metering systems by 2020.

16 Preamble 10, Directive 2009/72/EC

17 Article 9, Directive 2009/72/EC

18 Article 2 (1), EC 713/2009 and Article 1 EC 713/2009 respectively

19 CEER are the Council of European Energy Regulators, an organisation created to foster the dialogue among national regulatory authorities and between them and the European Commission. ERGEG (the European Regulators Group for Electricity and Gas) came about through the adoption of decision 2003/796/EC of the 11th of November 2003. This formalised the role of ERGEG in its dialogue with the EC (Hancher and de Hautecloque, 2010)

to work to implement EU law with the aim of completing the IEM (*ibid.).* Member States are required to guarantee the independence of the regulatory authority, ensuring that it is both impartial and transparent. According to their website, "ACER *plays a central role in the development of EU-wide network and market rules* with a view to enhancing competition". (ACER, n.d.). Thus, ACER is of vital importance to the development of Network Codes. They have provided non-binding Framework Guidelines (FGs) which serve as a basis for drafting the Network Codes. The European Network of Transmission System Operators for Electricity (ENTSO-E), are then responsible for drafting the 10 Network Codes as outlined in Article 8 of the Regulation below. They must ensure that the drafts are in line with the FGs outlined by ACER. Puka and Szulecki argue that the work of EU-level forums and institutions such as ENTSO-E and ACER are important for the legitimisation of market integration in Europe (2014). Jones and Webster argue that the establishment of an independent energy regulator is of vital importance to the success of the IEM (Jones & Webster, 2006). It is interesting then that it was not until 2009 that provisions for the establishment of such a body were put in place. Hancher and de Hautecloque argue that whilst ACER represents progress, as it will allow for a more structured approach for regulators to work together and go beyond a mere advisory role, the organisation itself will have limited power and thus represents a further formalisation of ERGEG (2010).

3.4.3 Regulation (EC) 714/2009

This regulation repeals Regulation (EC) 1228/2003 on conditions for cross-border exchanges in electricity. This Regulation contains new Congestion Management Guidelines (CMGs), updating those in the Annex of the 2003 legislation. This will be further discussed in Chapter 5.3. Whilst the Second Package Regulation represented the start of the EUs efforts to legislate on the issues of Capacity Allocation and Congestion Management, it was not sufficient to bring in the harmonisation required for the completion of the IEM. Karova states that "the level of cross-border electricity trade remains a benchmark for market integration. Insufficient transmission interconnection capacity, lack of transparency and great number of borders in combination with different transmission capacity auction mechanisms are the main reasons for limited cross-border trading" (2011, p. 84). Post-2003, progress remained limited. There had been some cooperation at the regional level in Europe, but generally this was voluntary.

Karova's research into the regional market in South East Europe (SEE) showed that a lack of political strategy lead to issues of implementing a Central Allocation Organisation (CAO) to oversee the region. Furthermore, whilst such an organisation was supported by the EC and SEE countries, progress towards actually developing it was limited because the support was generally verbal, rather than backed up with action. As it was seen as politically sensitive to remove the sovereignty over cross-border interconnection, the establishment of a CAO responsible for managing the capacity allocation and congestion management in the region was difficult (*ibid.).* She concludes that, as with other regions in Europe, political will is essential for the effective integration of national markets into regional markets, and then into a single IEM (2011). Whilst the regional approach had made progress, it was acknowledged that managing this process required more than a regional approach to both governance and the creation of rules (Squicciarini et al., 2010). Squicciarini et al. also posit that the separation of the "national" and the "cross-border" rules for both market coupling and congestion management systems is untenable as it does not reflect the technical features of electricity, nor the reality of the European grid network.

Thus, this Regulation also recognises that a pan-European body is needed to achieve the goal of a harmonised approach to congestion management in the EU and that this approach needed to be codified and applicable to all Member States. Key to the creation of this approach is the establishment of ENTSO-E, with the approach manifest in the new rules outlined in the Network Codes. The Network Codes represent a departure from the bottom-up process of the regional approach (Squicciarini et al., 2010). ENTSO-E is an organisation comprised of the Transmission System Operators (TSOs) in Europe. 41 TSOs from 34 countries are members of ENTSO-E; whilst the majority of Member States have one TSO member, some, such as the UK and Germany have four TSOs. These TSOs are required to work together to draft the Network Codes, as well as produce a biannual Europe-wide Ten Year Network Development Plan (TYNDP) which outlines "viable electricity transmission networks and necessary regional interconnections, relevant from a commercial or security of supply point of view".[20] Thus, ENTSO-E is in part responsible for the planning of new infrastructure at a European level. The formal role of the TYNDP in European electricity system development is further strengthened via Regulation (EU) 347/2013, in force since April 2013, through which the ENTSO-E TYNDP is mandated as the sole instrument for the selection of Projects of Common Interest (PCIs) (ENTSO-E, 2014a). This is discussed in more detail below.

3.5 The TEN-E Regulation

The Regulation 347/2013 on Guidelines for Trans-European Energy Infrastructure (TEN-E) sets out guidelines to help develop priority corridors of trans-European energy infrastructure. It amends Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009 and repeals Decision No 1364/2006/EC. The TEN-E Regulation is further recognition from the EU that more interconnection is vital to the integration of renewable energy sources and the completion of the internal market. This Regulation includes the concept of 'Projects of Common Interest' (PCI); energy infrastructure projects that help to develop the aforementioned priority corridors and thus qualify for streamlining and accelerating of the permit approval process as well as financial assistance from the EU.[21] This concept was originally introduced in Decision No 1364/2006/EC of the European Parliament and of the Council. These projects must either; involve at least two Member States; be located on one Member State but have a 'significant cross border impact' or cross the border of one Member State and one European Economic Area country.[22] The infrastructure categories are; electricity transmission and storage; gas; smart grids; oil transport; and carbon dioxide transport.[23]

Infrastructure projects can apply to be PCIs as long as they meet the criteria outlined in Article 4 of the Regulation. In 2014 €647 million was allocated to 34 proposals to allow for feasibility studies or work. This was largely for gas and electricity transmission lines although other projects, such as electricity storage, also received funding ('Projects of common interest', n.d.). The Baltic region received a large share of the funding as it has been identified as needing investment to allay security of supply issues. €112 million went towards work on an interconnector between Estonia and Latvia, while €55 million was allocated to an internal transmission line in Latvia. 3 UK-based projects received funding as part of the Northern Seas offshore grid Priority Corridor (NSOG). €31 million, €7 million and €1.7 million were allocated for studies to the NSN Link to Norway, the FAB Link to France and the Eleclink to France respectively (European Commission, 2014). There are two calls for proposals in 2015. The first round saw €159 million allocated to 20 proposals with most support going to projects in Central Eastern Europe, South Eastern Europe and the Baltic region. The closing date for the second round of proposals is 14 October 2015. In the initial round four projects from the NSOG region received funding for studies; three interconnectors and one compressed air energy storage project. These were the Celtic Interconnector from Ireland to France, the Greenwire (also

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[20] Preamble 9, Regulation (EC) 714/2009

[21] Article 1, Regulation (EC) 347/2013

[22] Article 1(c) (i-iii), Regulation (EC) 347/2013

[23] Article 2, Regulation (EC) 347/2013

known as Greenlink) from Ireland to the UK and the aforementioned Eleclink (European Commission, 2015a). This Regulation recognises that significant investment in infrastructure is needed if the IEM is to function effectively. It also introduces a method for the resolution of disputes over cross-border cost allocation (Meeus & Kayaerts, 2015). Should NRAs fail to agree on the cost allocation of "sufficiently mature projects" within six months, the ACER is expected to decide on their behalf. Thirteen PCIs have received such a cross-border cost allocation decision: twelve coordinated decisions by NRAs and, one decision by ACER (Meeus & Kayaerts, 2015). This is significant as it may help to speed up the resolution of disputes about cross-border interconnection, leading to a faster development of interconnectors in Europe. To summarise this section, Table 3 below outlines the key impacts of the legislation discussed above.

Table 3: Summary of the impacts of key EU legislation

	First Package (1996)	Second Package (2003)	Third Package (2009)	Ten-E (2013)
Summary of impacts	Initial break-up of Vertically Integrated Utilities (VIUs)	Faster implementation required due to slow progress of First Package	First steps towards harmonisation of markets with Network Codes	Promotion of interconnection development due to lack of capacity
	Introduction of TPA regimes and creation of 'eligible consumers'	Stricter unbundling regimes to further reduce market power of VIUs	Creation of pan-European agencies responsible for IEM	Funding and streamline of planning/approval process for PCIs
	No approach to integration of energy markets	Regional approach to integration of energy markets	Pan-European approach to integration of markets	Focus on infrastructure to allow for the integration of markets

Source: Authors own work based on a summary of the literature review

3.6 The Network Codes

Whilst the previous legislation aimed to break up monopolies and liberalise markets, the Network Codes look to move towards the completion of an actual single market, formalising the IEM. For electricity to be able to effectively move across borders, utilising an interconnected, Europe-wide transmission network, a common set of rules need to be in place. This is for a number of reasons; to ensure that TSOs are compensated for the additional use of their network; to ensure that capital-intensive infrastructure projects such as interconnectors are commercially viable; to ensure that conditions for access are well defined, equitable and without potential for rent seeking; and to ensure that markets, where possible, are well designed (Jevnaker, 2015). In the context of Europe, which, as discussed, has different energy market designs in different Member States, practical solutions for sharing cross-border resources and information have to be developed in order for integration to occur. It thus stands to reason that both strong regulatory oversight and collaboration between Member States on a regulatory and institutional level is required, in order avoid market distortions. This is manifest in the 'Network Codes', which are essentially the harmonised rules that the EU wish to govern the IEM, outlining who may use the electricity network and under what conditions (ENTSO-E, n.d.). These Codes are shown in Table 4 below. The Codes have been developed by ENTSO-E in consultation with wide a range of stakeholders across Europe and represent a significant step towards the completion of the IEM.

Table 4: The Network Codes

Code Type	Network Code
Connection	Requirements for Generators
	Demand Connection Code
	HVDC Connections
Operation	Operational Security
	Operational Planning & Scheduling
	Load Frequency & Control Reserves
	Emergency & Restoration
Market	Capacity Allocation & Congestion Mgmt.
	Forward Capacity Allocation
	Electricity Balancing

Source: ENTSO-E, (n.d.)

As discussed, cross-border interconnection does currently exist, although not on the scale required for there to be a functioning IEM (ENTSO-E, 2014a). The arrangements that govern these connections developed on a voluntary basis, with parties coming to bilateral arrangements for operating networks, also known as 'market coupling'. An example of this is the IFA interconnector between France and the UK, developed in 1986 through a joint-venture between the French and British TSOs prior to the First Package. The primary focus was security of supply and the efficient use of generation resources rather than on commercial objectives (Squicciarini et al., 2010). More recently, some regional areas have developed a more coordinated approach to market coupling, such as the Nordic region with the creation of the Nordpool market. However, Network Codes represent a radical departure from the bottom-up approach of the bilateral or regional process as they have been developed by pan-European institutions (ENTSO-E and ACER) and will apply across all Member States (Squicciarini et al., 2010).

3.6.1 Development Process

Regulations 714/2009 and 715/2009 of the Third Energy Package created two new organisations, ACER and ENTSO-E, who were tasked with working to complete the IEM.[24] They also obligated ENTSO-E to develop a set of Network Codes. The process for developing these Codes is outlined below in Figure 4.

[24] Articles 4, 6, 7 & 8 of Regulation (EC) 714/2009 on conditions for access to the network for cross-border exchanges in electricity

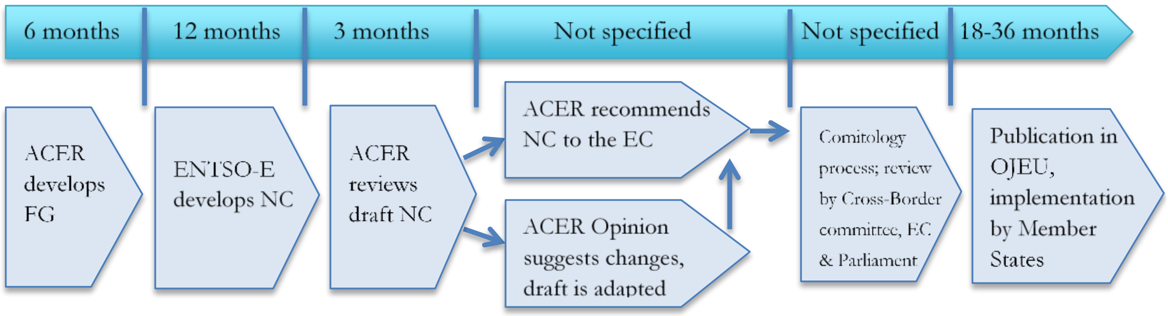

Figure 4: Network Code development process with timeline according to Regulation (EC) 714/2009

There are three key stakeholders in the development of Network Codes; ACER, ENTSO-E and the European Commission. First, the Commission requests that ACER formulate a draft Framework Guideline (FG). ACER then consults with key stakeholders, such as ENTSO-E and produces the FG – a process that should take no more than 6 months unless ACER makes a "reasoned request" for an extension to the Commission.[25] This FG is then fleshed out into a Network Code (NC) by ENTSO-E, who then send it back to ACER. The legislation stipulates that this should take 12 months.[26] ACER then has 3 months to review the draft NC, providing an 'Opinion' on it to the ENTSO-E. It will either recommend it for adoption, or recommend that it is revised by ENTSO-E before it recommends it for adoption[27]. After it has been recommended by ACER, the NC goes through the Comitology process. This has three phases. In the first phase, the NC's are prepared for the cross-border committee made up of Member State representatives. This committee then discusses and votes on the code. After this Committee has voted in favour of the NC it moves on to the European Council and Parliament for further scrutiny. Once it has approval from the Council and the Parliament the Code will be published in the *Official Journal of the European Union*, before being implemented by all Member States. ENTSO-E stated that CACM was expected to enter into force in "early 2015", with it actually passing Comitology in July 2015. With the CACM development process beginning in 2011 and the EU anticipating that the codes would be completed by 2014, it is clear (and perhaps not surprising, given the nature of the task) that the development process has taken longer than expected (ENTSO-E, 2011; Jevnaker, 2015). CACM was the first Network Code to have entered the Comitology process (in December 2013). However, the discussions at the cross-border committee that were scheduled to last a maximum of six months actually lasted over a year due the aforementioned debate surrounding the label of the legislation (ENTSO-E, 2014b).

3.7 Summary; Progress Towards an Internal Market for Energy?

To summarise, The Third Package, embodied by the development of ACER, ENTSO-E and the Network Codes, represents a push towards the integration of European markets after the design of national markets reached a relative stability (Squicciarini et al., 2010). This is also noted by Howard and Sadeh, who argue that "while the new Directive will bring about a change in national practice in Member States that traditionally opposed unbundling [such as France and Germany], it remains a dangerously unprecedented piece of EU legislation that explicitly recognises differentiation in the operation of national energy markets" (2010, p.929). Thus, whilst the 'stability' mentioned by Squicciarini is beneficial, it does not mean that the unbundling

[25] Article 6(2) of Regulation (EC) 714/2009

[26] Article 6(6) of Regulation (EC) 714/2009

[27] Article 6(7) of Regulation (EC) 714/2009

of utilities has taken place in the most competition-enhancing way. Whilst the EU aimed to complete the IEM by 2014, the slow transposition of the Third Package and the delays surrounding Network Code development meant that ultimately this goal was not achieved (Newbery & Goldberg, 2013). Furthermore, the transmission infrastructure desperately needed for a functioning market was still lacking; both internally and cross-border. This was recognised by the Commission, with the EU providing particular support to projects selected by ENTSO-E as "Projects of Common Interest". So far, over €800 million has been allocated to projects, particularly interconnectors. Further to this, the dispute mechanism outline in the TEN-E Regulation may lead to further development of interconnection, overcoming some of the existing political and institutional barriers faced by projects.

4 Approaches to Interconnector Development

Based on a literature review, this section thus looks to answer research question 1; what are the different approaches to interconnector development? van Koten argues that there are two approaches to interconnector development; the merchant approach and the regulated approach (van Koten, 2012). This chapter outlines these two approaches, paying specific attention to the British context. It also introduces some of the debate surrounding the two models. It then provides an introduction to the new cap and floor regime which has recently been developed by OFGEM and CREG, the British and Belgian energy regulators respectively. Although no interconnectors have yet been built under this regime, several are in the development stage. This regime would render van Koten's typology obsolete, creating a third approach for interconnector development moving forward.

4.1 The Merchant Approach to Interconnector Development

The author defines merchant interconnectors along with de Hautecloque and Rious, who state that they are profit-seeking investments in cross-border transmission infrastructure developed by non-regulated market actors (de Hauteclocque & Rious, 2011). They monetise the investment through exploiting price differences in the connected markets, buying where the price is cheap and selling where the price is high, to maximise congestion rent – the price difference multiplied by the volume sold. [28] It is important to understand this in relation to the regulated approach. With the regulated approach, the investment is not undertaken by a private market actor but by two TSOs in the respective countries. The interconnector is seen as part of (rather than separate to) the existing transmission grid. Because transmission grids are generally seen to be natural monopolies, the interconnector is also treated as such, with income recouped through network tariffs rather than the maximisation of congestion rent (Moore & Newey, 2014). [29] However, this investment is underwritten by the taxpayer whereas the developer of the merchant project takes on the risk in return for the reward of profits. This is a key point. Interconnectors are large infrastructure projects characterised by high costs and high risks; Turvey argues that the uncertainties surrounding profitability are substantial because both electricity prices and future regulation are difficult to predict (Turvey, 2006). For example, the NSN Link to Norway that is currently under development is projected to cost around €2 billion (nsninterconnector.com, 2015). Furthermore, these projects are the result of lengthy development and planning process – interviews conducted with stakeholders in the National Grid backed up Jacottet's assertion that it can take years or even decades to go from feasibility study to completed interconnector (Jacottet, 2012).

A purely merchant interconnector would have the ability to operate how it chooses in a free market, maximising congestion rent. In practice, this simply does not exist. Rather than the dichotomy between 'merchant' and 'regulated', in practice there is no longer such a thing as a purely merchant interconnector because all newly built interconnectors are regulated to different extents and in different ways by the EU, as will be discussed in more detail below in Chapter 4.3. However, the EU does allow for some flexibility to these rules with 'exemptions' being possible – also discussed in Chapter 4.3. Thus, in today's European context 'merchant' interconnectors could be defined as those that remain for-profit but have been granted some form of exemption from EU requirements, or a cap and floor regime. However, for simplicity, the author still uses the merchant/regulated categories whilst keeping this important caveat in mind.

[28] Also referred to as 'arbitrage'

[29] See Chapter 4.4. for further discussion on natural monopolies

4.2 The Merchant Approach in the UK Context

The UK favours a merchant approach to interconnection development. This is underlined by the fact that under UK law, interconnectors cannot be part of the Regulated Asset Base (RAB) of the transmission grid. A review of this regime was undertaken by the independent British energy regulator, OFGEM, between 2012 and 2015 and found that this 'merchant approach' remained the best option for Britain (OFGEM, 2013b, 2015b). This is further discussed in Chapter 6. Thus, interconnectors cannot be built by the UK TSO, National Grid, whilst in the rest of Europe it is these very system operators who are responsible for developing new interconnection (Littlechild, 2012).[30] This can make linking two countries complex, leading to a long development process where different regimes have to be aligned (Puka & Szulecki, 2014). As shown in Table 5, the UK has four interconnectors with a total capacity of 4GW, or around 5% of UK installed production capacity.

Table 5: Existing UK interconnectors

Name	Link to	Capacity	Built	Owner	Approach	Notes
IFA	France	2GW	1986	JV; NGIC/RTE	Merchant	Built prior to EU legislation on IEM
BritNed	Netherlands	1GW	2011	JV; NGIC/TenneT	Merchant	Exemption granted but with profits limited – key EU decision on merchant approach
Moyle	Northern Ireland to Scotland	0.5GW	2001	Mutual Energy	Merchant	Has had intermittent operation and has been undergoing repairs since 2012
East West	Republic of Ireland-Wales	0.5GW	2012	Eirgrid	Regulated	Only fully regulated interconnector in GB

Source: Authors own research based on company websites and project documents. For a summary of acronyms, please refer to Appendix II

This is under the target set by the EU of 10% by 2020 and 15% by 2030, applicable to all Member States (European Commission, 2015b). However, there are other interconnectors in the pipeline, as shown by Table 6. If all of these were built to full capacity it would boost capacity by 10.3GW; more than doubling existing links. However, a new merchant interconnector hasn't been built since 2011, despite an appetite from both the UK government and EU stakeholders for more capacity. The Nemo and NSN projects are expected to begin construction in 2015 or early 2016 and are thus the closest to being realised. These projects have been regulated under a new 'cap and floor' regime which is discussed in more detail in Chapter 4.5.

[30] It is important to clarify here that the National Grid has a separate "non-regulated" business responsible for developing new interconnectors. Income from this business is not assessed as part of the RAB, and thus the goal is to maximise return on investment for shareholders. This is a legally separate company from the System Operator aspect of National Grid, also known as NGET, National Grid Electricity Transmission. This separation is in order to comply with UK law.

Table 6: UK-based interconnectors in development

Name	Link to	Capacity	Expected Commissioning	Owner (JV unless singular)	Notes
Nemo	Belgium	1 GW	2018 (construction phase started)	NGNLL/Elia	First interconnector to operate under 'cap and floor' regulatory regime
NSN Link	Norway	1.4 GW	2020 (construction phase started)	NGNSNLL/ Statnett	Will be longest subsea interconnector in the world and provide access to hydro
Viking	Denmark	1-1.4 GW	2020	NGIH/ Energinet.dk	Cap and floor regime agreed by OFGEM July 2015
IFA2	France	1 GW	2020	NGIC/RTE	Second link between existing project partners for the IFA link
Icelink	Iceland	0.8-1.2 GW	2024	NGIH/ Landsvirkjun	Project is in the earliest stages of development of those on the list
North Connect	Norway	1. 4 GW	2021	Agder Energi, E-Co, Lyse, Vattenfall	Provides competition to the NSN Link
Eleclink	France	1 GW	2017	Groupe Eurotunnel/ Star Capital	Able to sell 80% of capacity via long term contracts due to exemption - cap and floor does not apply
FAB Link	France	1.4 GW	2020	Transmission Investment/ RTE	Awarded cap and floor regime July 2015. Project designed to allow the potential connection of future tidal generation
Greenlink	Ireland	0.5 GW	TBC	Element Power	OFGEM decided against awarding cap and floor, July 2015

Source: Authors own research based on company websites and project documents. For a summary of acronyms, please refer to Appendix II

4.3 The Regulated Approach

As discussed above, the regulated approach to interconnector development is where interconnectors are treated as part of the RAB and seen as an extension of the grid network, managed by a national TSO who are traditionally a monopoly. This is the predominant method for interconnection for countries in the EU. This is in line with the 'traditional' approach to transmission investment, whereby expansions were proposed by the incumbent vertically integrated utility, approved by the regulatory body and financed by an addition to the network rates paid by users (Littlechild, 2012). Regulated interconnectors are financed through increases to network tariffs for users, as well as revenues from arbitrage between the two countries, as is the case with the NorNed interconnector between Norway and the Netherlands. This interconnector is joint-owned by the Dutch TSO, TenneT, and the Norwegian TSO, Statnett, who share costs and revenues on a 50-50 basis (de Nooij, 2011). However, unlike the merchant approach, these investors are less concerned with maximising congestion rent because rent above the regulated tariff cannot legally be taken as profit. As regulated interconnectors are seen as extensions of the grid, it could be argued that the regulated model is subject to the challenges of regulated monopoly, defined by Joskow and Tirole as "how to specify and apply regulatory mechanisms that provide good performance incentives to the regulated firm while minimizing the economic rents that the regulated firm can derive from its superior information" (Joskow & Tirole, 2005, p. 234).

4.3.1 EU Regulation

This section presents the relevant articles of Regulation 714/2009 (EC), which sets the regulatory regime under which all interconnectors in the EU must operate.

EU Regulation on Third Party Access (TPA) is of utmost importance to interconnector developers. It stipulates that interconnector capacity cannot be charged for *unless* the interconnector is congested.[31] Thus, if there is an oversupply of cross-border capacity on the interconnector, this capacity must be supplied free of charge. When an interconnector is congested, the TSO must address these problems via "non-discriminatory market based solutions", such as an auction.[32] This prohibits the use of long-term contracts as a method for allocating capacity, which the EU sees as detrimental to competition. Furthermore, any revenues from congestion rent can only be used for specific purposes relating to improving the functionality of existing interconnectors, investing in new capacity, or reducing network tariffs to benefit consumers.[33] The central idea with this latter clause is to force the owner of the interconnector to invest in further transmission capacity, either in interconnectors or other parts of the grid (Talus & Walde, 2007). This essentially mandates the regulated model as the de facto model for new interconnector development.[34] However, there is a space for merchant investors, who can apply for an exemption from these rules for a pre-specified time period under Article 17. Full exemptions give developers more information on cash flow, allowing them to determine the payback period for the investment, although full exemptions are rarely given as they may be detrimental to competition (Cuomo & Glachant, 2012). The possible reasons for exemptions are listed below in Figure 5. Talus and Walde argue that exemptions are a compromise between two interrelated aims: the promotion of the IEM and the need to ensure free competition and third party access to the necessary infrastructure. The logic behind such an exemption is to favour long-term efficiency gains over short-term advantages: if capacity reservations and priority rights are necessary for the construction of an interconnector then they must be accepted, but only for a limited period (Talus & Walde, 2007). Thus, the EU has to balance between allowing for new interconnector developments, whilst ensuring that they are not detrimental to competition or the maximisation of social welfare across the IEM.

(a) the investment must enhance competition in electricity supply;
(b) the level of risk attached to the investment is such that the investment would not take place unless an exemption is granted;
(c) the interconnector must be owned by a natural or legal person which is separate at least in terms of its legal form from the system operators in whose systems that interconnector will be built;
(d) charges are levied on users of that interconnector;
(e) since the partial market opening referred to in Article 19 of Directive 96/92/EC, no part of the capital or operating costs of the interconnector has been recovered from any component of charges made for the use of transmission or distribution systems linked by the interconnector;
(f) the exemption is not to the detriment of competition or the effective functioning of the internal electricity market, or the efficient functioning of the regulated system to which the interconnector is linked.

Figure 5: Article 17(1) Regulation 714/2009; exemption conditions for new interconnectors

[31] Regulation 714/2009, Annex I (1.2)

[32] Regulation 714/2009, Article 16(1)

[33] Regulation 714/2009, Article 16(6)a & b

[34] The IFA interconnector, build in 1986, precedes this legislation and is thus not regulated in this way

Exemption decisions are taken on a case-by-case basis by the National Regulatory Authorities (NRAs) of the Member States involved, although is subject to final approval from the European Commission who have the power to either veto the decision or impose additional conditions.[35]

Rubino and Cuomo's recent paper reviews the five exemption decisions taken by the EC. Of these interconnections, three are UK-based, with the other two being a subsea HVDC (High-Voltage Direct Current) link from Finland to Estonia and the other an HVAC (High-Voltage Alternating Current) link between Austria and Italy (2015). This shows that the majority of merchant developers are UK-based. In addition to this, Table 6 in the above section shows that there are a further eight merchant projects in the pipeline, not including Eleclink to avoid double counting. Furthermore, the UK is the only Member State whereby the TSO is not the body responsible for the development of interconnection, where competition between developers is promoted. From this it can be concluded that whilst merchant interconnection is not purely a UK-based business model, the majority of merchant developments are from the UK.[36]

Of the three UK-based projects to receive an exemption, only one has been completed; the BritNed interconnector in 2011. The 2008 Imera project between Ireland and the UK appears to have stalled since receiving an exemption, whilst the Eleclink project that received its exemption in 2014 is in the planning phase. Rubino & Cuomo state that the EC intervened in four out of the five because they felt that the interconnectors would be to the detriment of competition (2015).[37] Furthermore, they argue that the conditions of these exemptions are becoming increasingly stringent. This has reduced confidence that merchant operators will recoup their investment and make a profit, leading to a dampening effect on investment which ultimately is harmful for the EU who see a connected grid as vital for the IEM (Rubino & Cuomo, 2015). For example, in the case of the UK, there has been no new investment in interconnection since the 2007 exemption decision on the BritNed interconnector between the Netherlands and the UK. This is a key point to the UK context, and will be discussed in more detail below.

4.3.2 The BritNed Decision

In 2007, BritNed requested an exemption from the statutory TPA regime which for a period of 25 years in order to recoup the investment. This was denied by the Commission who were concerned that the interconnector was in breach of Clause 7 (see Figure 3 above, in bold) and that wider social welfare benefits were not taken into account (OFGEM, 2013a). The EC "were not convinced that the proposed size of the interconnection cable is the optimal balance between rewarding BritNed for undertaking the investment and the benefit for consumers on both sides. The exemption decisions of the national regulators do not carry out a sufficiently detailed assessment of the capacity" (European Commission, 2007, p. 7). The Commission requested the addition of a further condition as a "regulatory safeguard". This condition requires BritNed to submit a report after ten years of operation to both the UK and Dutch regulators containing information on the costs, revenues and rates of return of the project to be scrutinised as compared with the data provided in the original exemption request. Crucially, if the estimated internal rate of return of the project is more than 1% above that *initially estimated* then BritNed must either "increase the interconnector capacity to such an extent that the initially estimated

35 Regulation 714/2009 (EC), Article 17(4)

36 The author argues that this further justifies the choice of the UK as the focus of this study, as discussed in Chapter 1.4.

37 The exception here is the first exemption request, granted to the Eastlink interconnector in 2005; a 350MW link between Estonia and Finland which requested a full exemption from regulatory third party access and restrictions on use of congestion revenues

rate of return is met or *cap profits that exceed the original estimate* and use them to finance the regulated asset base in the UK and the Netherlands" (ukpracticallaw.com, 2007, emphasis added). This decision to effectively cap profits spelled the end for the ability of merchant operators to maximise congestion rent, even within the confines of the strict regime, leading to what Cuomo and Glanchant call a "de facto chilling effect" on merchant transmission investment, in spite of the EU's need for further interconnection to help the completion of the IEM (2012, p. 4).

4.4 The Debate Surrounding the Two Models

There is considerable debate as to the role that merchant transmission investment has to play in what has traditionally been a regulated space (Littlechild, 2012). With the liberalisation of the electricity and gas industries, the EU has sought to use competition to drive improvements in efficiency, incentivise to investment in new infrastructure and shift risks from consumers to suppliers (Joskow, 2008). However, Joskow argues that the development of an effective transmission investment framework continues to be a significant challenge in many countries with investment not keeping pace with those in the power markets which has increased demand for capacity, leading to further cross-border congestion (*ibid.).* A purely merchant approach to transmission investment is widely regarded as being inefficient, hence the grid being seen as a natural monopoly (Joskow & Tirole, 2005; Philipson & Willis, 2006). A natural monopoly arises when a market is best served by one firm, rather than a range of competing firms (Baldwin, Cave, & Lodge, 2011). Joskow and Tirole argue that relying primarily on market-based merchant transmission investment is likely to lead to inefficient investment in transmission capacity (2005). Regarding "network deepening" investments – those to upgrade or maintain the existing network; if merchant operators were allowed to invest, they would be likely to *under invest* in capacity. This would increase the congestion on the interconnector, leading to higher congestion rent. The incumbent monopoly TSO has no incentive to undertake such behaviour, leading to the socially optimum level of investment. Furthermore, the information on the needs of such upgrades is possessed by the incumbent monopoly, making them best placed to do such work. However, they argue that "network expanding" investments, or building new transmission lines, are the most likely candidate for successful merchant investment (Joskow & Tirole, 2005). Thus, there is an argument that new interconnectors could successfully be undertaken using the merchant approach as long as a range of market imperfections are addressed.

However, whilst it is the most used, there is also argument that the regulated approach is flawed in certain contexts; a view shared by OFGEM who feel that the merchant approach means that UK consumers aren't exposed to the significant costs or risks associated with interconnector projects. This will be further discussed in Chapter 6. The issue is further complicated by the fact that in many Member States the national TSO cannot embark on "exempt" interconnector projects, nor do they allow third party's to invest in interconnection unless the national TSO is involved (OFGEM, 2013a). This is evidenced in Table 6 above, which shows that non-regulated companies of the National Grid are project partners to national TSOs in the majority of cases. In some cases, national law prevents regulated returns being given to a party that is not the national TSO meaning that merchant interconnection, even under a semi-regulated approach such as the cap and floor, would not be possible.

To sum up, the author believes, alongside Joskow and Tirole, that the balance between the merchant and the regulated approach should allow for a regulatory mechanism (or mechanisms) that facilitate efficient investment and operating decisions by regulated TSOs, stimulate merchant investment when it is more efficient, and convey the net benefits of efficient investment and operating decisions made by both regulated and merchant transmission owners to consumers (2005). That aim is, to some extent embodied by the Third Energy Package and its stipulations on Third Party Access rules, although the author would argue that the balance called for has not been effectively implemented, due to the restrictions placed on merchant developers as exemplified by the BritNed Decision. According to Littlechild, the Third Energy Package legislation intensified the debate as to which is the most appropriate regulatory and market model for fostering interconnection development (2012). This is a debate which may continue with the new measures proposed by the Network Codes, but needs to be efficiently concluded should the EU wish to develop the level of interconnection required for an effective IEM.

4.5 The Cap and Floor Regime

This section provides an introduction to the new 'cap and floor' regime for interconnector development. The cap and floor regime was developed between 2011 and 2013 by OFGEM in partnership with CREG, the Belgian NRA (OFGEM, 2014b). The aim was to provide the planned NEMO interconnector between Belgium and the UK with a route to development after the EU's decision on the BritNed project left merchant developers unconvinced of the existing business model, as profits were constrained but risk was not. With OFGEM recognising the benefits to British consumers associated with interconnectors, they designed a new regime that allowed developers to propose projects via a market-based approach whilst ensuring that both risks and rewards were more appropriate (OFGEM, 2014b). The regime is more in line with the traditional model of regulation for transmission systems, where any profits above the cap level passed onto consumers in the UK and Belgium. However, whilst with the transmission system any costs of investments in the network are passed on to consumers through network tariffs, under the cap and floor, consumers are only exposed to costs when revenues for the project *drop below the floor level*. If the project drops below the floor level, OFGEM allows for revenue to be 'topped up' via network tariffs, paid by consumers. OFGEM states that "the cap and floor regime is designed such that a project only goes ahead if revenues are expected to exceed the floor" (2014b, para. 5).

Under the cap and floor regime, projects can apply to OFGEM at the Initial Project Assessment (IPA) stage. Prospective projects submit an estimate of costs and revenues, with OFGEM setting the cap and floor ex-ante based on these estimates. Thus, being able to accurately estimate costs and revenues is of utmost importance to both project developers and investors. The floor level of revenue is designed to ensure that developers recover the cost of the project, whilst the cap attempts to cede the fears of the EU that developers will undersize projects to maximise congestion rent at the detriment of social welfare. The levels of the cap and floor remain fixed (in real terms, so adjusted for inflation) for the lifetime of the regime, normally twenty-five years. CEPA state that the regime is set based on costs using a Regulatory Asset Value model taking into account; depreciation of the capital, to allow return of capital invested; financing costs, to allow a return on capital invested; and operating expenditure (CEPA, 2014). Once operational, revenues are assessed every five years to determine whether the cap or floor is triggered (OFGEM, 2014b).

The NEMO interconnector has not yet been constructed and thus as of yet, no interconnectors have been built under the cap and floor regime. However, since the regime was rolled out for UK interconnectors a further five projects have applied to use the regime at the IPA stage. Of these five, one has been awarded the regime; the NSN Link from Norway to the UK. Of the four remaining projects, OFGEM is 'minded to' award the regime to three; FAB Link, IFA2 and Viking Link (mentioned above in Table 6). This is because they feel that the projects are beneficial to UK consumers. This 'minded to' decision is preliminary and subject to consultation, with a final decision taken in summer 2015. It is also subject to the costs of the project not escalating beyond the level agreed in the cap and floor regime. They were minded not to award the regime to the Greenlink project because the project does not seem to be in the interests of GB consumers (OFGEM, 2015a).

Although there is still the "exemption" route, the cap and floor regime looks to be the de facto merchant approach for interconnection going forward in the case of the UK. However, as of yet the author could find no independent academic research on the regime. This is likely to be because as of yet, no project has been constructed and entered operation under the cap and floor. Whilst developments will doubtless be followed by OFGEM, it would nonetheless provide an interesting area of academic research going forward.

5 The Network Code on Capacity Allocation and Congestion Management

5.1 Introduction

The author has found a gap in existing literature on the impacts of the Network Codes on interconnector development under the merchant approach. Thus, the following chapter contains a legal analysis of the Regulation (EU) 2015/1222 establishing a guideline on capacity allocation and congestion management (CACM). CACM was published in the Official Journal of the European Union on 24th July 2015, entering into force 20 days later on 14th August. This assessment will look at the semantics of the text, with assertions about implications supported by previous EU Decisions, rulings by the Advocate General, literature and data provided by expert interviews. Naturally, with CACM so early in its implementation there is no directly applicable case law. Thus, the author has drawn on Decisions related the implementation of the IEM, of which CACM is also a part. This section aims to provide insight into RQ3, looking at how CACM will impact on the merchant approach for interconnector development.

5.2 Aims and intent

The Network Code on Capacity Allocation and Congestion Management (CACM) aims to provide a set of detailed guidelines that will harmonise how electricity is transported and traded across Europe, recognising that currently markets and the rules that govern them are largely national in scope. Specifically, CACM pertains to the allocation of transmission capacity in both the day-ahead and intraday markets, including how to deal with congestion in a non-discriminatory way. Article 3 outlines the objectives in full, stating that the Regulation aims at:[38]

> (a) Promoting effective competition in the generation, trading and supply of electricity;
> (b) Ensuring optimal use of the transmission infrastructure;
> (c) Ensuring operational security;
> (d) Optimising the calculation and allocation of cross-zonal capacity;
> (e) Ensuring fair and non-discriminatory treatment of TSOs, NEMOs, the Agency, regulatory authorities and market participants;[39]
> (f) Ensuring and enhancing the transparency and reliability of information;
> (g) Contributing to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union;
> (h) Respecting the need for a fair and orderly market and fair and orderly price formation;
> (i) Creating a level playing field for NEMOs;
> (j) Providing non-discriminatory access to cross-zonal capacity.

It is well documented that cross-border transmission capacity in Europe is currently scarce, leading to congestion; a significant barrier to a functioning IEM (ENTSO-E, 2014a; Kapff & Pelkmans, 2010; Rubino & Cuomo, 2015; van Koten, 2012). Furthermore, the weak integration of separate national systems to manage congestion is inefficient, resulting in inefficient dispatch by generators, a need for costly redispatching from TSOs and, ultimately, higher total supply costs for electricity customers (Squicciarini et al., 2010). To ensure an efficient management of congestion Squicciarini et al. argue that a greater harmonisation of congestion management schemes is needed (2010). As discussed in Chapter 1.1.3, congestion occurs when there is

[38] Article 3, Regulation (EU) 2015/1222 establishing a Guideline on Capacity Allocation and Congestion Management

[39] NEMOs are Nominated Electricity Market Operators in respective Member States, more commonly known as Power Exchanges such as NordPool, or APX. The Agency is the term used to refer to ACER by the EU

insufficient transmission capacity to transport the demanded quantity of electricity.[40] In Europe, internal congestion is mostly dealt with through 'redispatching' (Squicciarini et al., 2010). Market participants are allowed to negotiate power sales as if unlimited transmission capacity was available – irrespective of the actual network capacity. This can lead to situations where there is not enough capacity to provide for all the power that has been bought. To manage this, after the auction for capacity has closed, participants are paid by the TSO to change their schedule (i.e. take power when the network is not congested) in order to ensure that flows of power are within the system constraints (Squicciarini et al., 2010). This is in contrast to 'implicit auctions' which limit market transactions to those compatible with actual network capacity. This is method that is favoured by CACM, and will be discussed below.

CACM's legal framework is intended to remove barriers to trade and allow for a more liquid and efficient market for electricity in Europe which will benefit consumers.[41] CACM will apply to all transmission systems and interconnections in the Union except the transmission systems on islands which are not connected with other transmission systems via interconnections.[42] The intention is that CACM will provide further progress towards the completion of the IEM, as has been outlined above.

5.3 Key Principles

As introduced in Chapters 3.3 and 3.4.4, the Principles behind Congestion Management in the EU were first introduced in Regulation (EC) 1228/2003 of the Second Package, and updated in Regulation (EC) 714/2009 of the Third Package. They have been further revised for CACM, and are discussed below. The aim of CACM is to harmonise the rules that govern separate national and regional electricity markets in Europe. It is grounded in the principles that guide the EU, including the creation of a single, competitive non-discriminatory internal market with the free movement of goods.[43] CACMs aim is manifest according to the principles outlined in Article 16 of Regulation (EC) 714/2009, outlined below. The first principle is that network congestion problems shall be addressed with non-discriminatory, market-based solutions.[44] In line with this, long-term 'transaction based' methods for capacity allocation, such as contracts, are discouraged because they are viewed as detrimental to competition. A request can be made for an exemption, as long as certain criteria are met.[45] This preference can be an issue for interconnector developers who can reduce uncertainty and secure revenue streams through contract-based capacity sales (Mäntysaari, 2015).[46] Bearing in mind safe use of the system, interconnectors should be used at full capacity. Any capacity that is reserved but then not used should be offered back to the market for resale to prevent strategic hoarding and to allow for

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40 See Article 2(2)(c) of Regulation (EC) 714/2009 "a situation in which an interconnection linking national transmission networks cannot accommodate all physical flows resulting from international trade requested by market participants, because of a lack of capacity of the interconnectors and the/or the transmission systems concerned".

41 Recital 3 of Regulation (EU) 2015/1222

42 Recital 2 of Regulation (EU) 2015/1222

43 Articles 4(2)(a), 26, 27, 194 and 195 of the Consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union 2012/C 326/01

44 Recital 33 of CACM states that "this Regulation supplements Annex I of Regulation (EC) No 714/2009, in accordance with the principles set out in Article 16 of that Regulation". Article 16(1)-(6)(b) is outlined here.

45 Article 1(1.6) Regulation (EC) 714/2009

46 The IFA interconnector, completed in 1986 prior to EU legislation on the IEM, allocates capacity based on long-term contracts between the National Grid and RTE. The Eleclink interconnector, also between France the UK and planned to be commissioned in 2017, has received an exemption from this clause, allowing it to sell 80% of its capacity using long term contracts as mentioned in Table 5.

variable capacity to be traded.[47] Capacity should only be curtailed in the case of an emergency and the maximum capacity of the interconnector and system needs to be made available to all market participants in a non-discriminatory way. This principle was tested in 2010 when the Commission adopted a commitment Decision that addressed the concern that Svenska Kraftnät ('SvK'), the operator of the electricity transmission grid in Sweden, may have abused its dominant market position according to Article 102 TFEU. In times of internal congestion in the Swedish system, SvK were found to have limited exports of capacity via interconnectors, thus favouring the utility of their own system over the utility of other network users. Their position as the monopoly TSO allowed them to discriminate against other non-Swedish network users, treating requests for transmission for the purpose of consumption within Sweden differently from requests for transmission for the purpose of export. This preventing others from accessing the benefits of the IEM – an action that was found to be both harmful to competition and consumers (Chauve, Glowicka, Godfried, Leduc, & Siebert, 2010). This ruling upheld the EC's view that, operational security notwithstanding, national energy systems were *not* to be prioritised over the overall welfare of the IEM - a strong message that could also be seen to be impeding on the sovereignty of Sweden to maximise welfare for their own citizens.

Another key principle is that any congestion rent gained from the allocation of capacity should be used to guarantee availability of allocated capacity, or to maintain or increase interconnector capacity (as opposed to being taken as profit).[48] This principle promotes the regulated model of investment rather than the merchant model. However, as mentioned in Chapter 4, new interconnectors can get exemptions from these provisions if certain conditions are met. This is in recognition of the fact that interconnectors are high risk and high cost investments and that a regulated approach may prohibit investment in vital infrastructure; counter to the goal of the EU. The decision to grant an exemption takes place on a case by case basis (van Koten, 2012). A detailed analysis of these exemption decisions is undertaken in Rubino and Cuomo (2015) and is further referenced in Chapter 4.

5.4 Key Articles

This section outlines the findings from some of the key articles in CACM. Expert interviews highlighted six areas where CACM is likely to impact on the merchant model for interconnector development. Thus, this section will be structured according to those areas; Bidding Zones; Capacity Calculation; Day Ahead Market Coupling; Intraday Market Coupling; Firmness of Capacity and Cost Recovery. Rather than outline the rules themselves, in general CACM provides a high level overview that stipulates what needs to be developed, who should develop it and by what date. CACM legislates for cooperation to an extent that is unprecedented for energy markets, with TSOs, power exchanges (or National Energy Market Operators – NEMO's, as CACM defines them), ENTSO-E, ACER and National Regulatory Authorities (NRAs) all working together.[49]

5.4.1 Bidding Zones

As part of CACM, Europe will be split into bidding zones. OFGEM states that a bidding zone is the largest geographical area within which market participants are able to exchange energy without capacity allocation (OFGEM, 2014a). Currently, most European bidding zones are defined by national borders with the Nordic region being a notable exception – Norway and

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47 Market participants will buy capacity for a certain period based on calculated need. Prior to use, market participants report to the System Operator how much capacity they expect to actually use, known as 'nominating'. However, the actual capacity nominated may be less than the amount bought.

48 Article 7 of Regulation (EC) 1228/2003

49 Article 9, Regulation (EU)2015/1222 establishing a Guideline on Capacity Allocation and Congestion Management

Sweden split up into several smaller zones. Thus, whilst there is a single price across the UK bidding zone, prices vary across the four zones in Sweden, reflecting short-term costs of generation and transmission and network constraints in each zone and promoting efficiency both in investment and dispatch (Mäntysaari, 2015). CACM states that bidding zones are "a cornerstone of market-based trading and a prerequisite for reaching the full potential of the flow-based method of capacity allocation".[50] CACM represents a significant departure from the norm as it allows for the redrawing of zonal borders with the aim of making the market function more efficiently, with borders configured according to the location of congestion to stimulate investment in that zone.[51] According to OFGEM, a review of the efficiency of existing bidding zones is likely – how they are reconfigured could have a significant impact on market signals (OFGEM, 2014a). One interviewee pointed out that such a fundamental change in how markets are structured would be a lengthy and politically difficult process, as echoed by Karova in her discussion on the SEE region, outlined in Chapter 3.4.4 (2011). Research by OFGEM suggests that the current UK configuration is sub-optimal as having a single, Britain-wide bidding zone means that market participants do not need to consider congestion on the transmission network, impacting on the incentive to locate new generation and transmission capacity in the most needed location (OFGEM, 2014a). CACM states that each bidding zone, bidding zone border, or two separate bidding zone borders if applicable, through which interconnection between two bidding zones exists, shall be assigned to one capacity calculation region.[52] It recommends that bidding zones be defined so as to support congestion management and market efficiency by defining bidding zones by congestion as opposed to national boundaries, as is currently the case in most Member States (Bayer, 2015). That could lead to a situation whereby interconnectors that once connected two different bidding zones (such as France and the UK) became part of the 'internal' grid infrastructure for the same zone. More research is needed to understand how this would impact on revenues; however, it is fair to assume that the configuration of bidding zones can have a significant impact on price signals and incentives to invest for current and prospective interconnectors, and that the situation described above, whilst potentially increasing social welfare overall would have a detrimental impact on merchant interconnectors and their ability to collect congestion rent. Furthermore, the fact remains that this issue is an issue for the British system and that any mandated changes to bidding zones would constitute a rescinding of the sovereignty of UK institutions to decide over the method that they feel are best for that system. An investigation into this review process is outside of the scope of this thesis. However, the author acknowledges that this review process is likely to involve the input of UK bodies such as OFGEM, who can influence the outcome of such a review. Whether any Member States would accept drastic and potentially significant changes to market architecture, should they be put forward, remains to be seen. Regardless, it is clear that a re-drawing of bidding zones in Europe will have implications for both the future of the IEM and both merchant and regulated interconnection moving forward.

5.4.2 Capacity Calculation

Capacity calculation is one of the cornerstones of this Regulation, with Recital 27 stating that: "the objective of this Regulation, namely the establishment of single day-ahead and intraday coupling, cannot be successfully achieved without a certain set of harmonised rules for capacity calculation, congestion management and trading of electricity". Traditionally, Member States invested in enough transmission capacity to ensure the effective functioning of their own electricity system. The development of interconnection meant that they could access power

[50] Recital 11, Regulation (EU)2015/1222

[51] Article 32, Regulation (EU) 2015/1222

[52] Article 14(2), Regulation (EU)2015/1222

from other systems. Countries developed different methodologies for calculating the available capacity that was available to be exchanged via interconnection, with the UK using the Net Transmission Capacity (NTC) method. ENTSO-E argue that the NTC method is well known and has been widely used in Europe since the beginning of market liberalisation (ENTSO-E, 2011). The NTC approach favoured by much of Europe defines ex-ante the maximum capacity available on interconnections between the two bidding zones (such as France and the UK). This is generally based on the security limits of the two bidding zones and the interconnector itself. As OFGEM acknowledged in an interview, this means that generally interconnectors can allocate 100% of their capacity and this is only curtailed if the interconnector itself has a problem.[53]

CACM states that "to implement single day-ahead and intraday coupling, the available cross-border capacity needs to be calculated in a coordinated manner by the Transmission System Operators".[54] This calculation should be coordinated *at least* at regional level to ensure that it is reliable and that optimal capacity is made available to the market.[55].Thus CACM represents a departure from the national approach because available capacity will be calculated regionally, according to capacity calculation regions.[56] The following section will discuss initially the implication of capacity calculation regions, before analysing the impact of the capacity calculation methodology.

Capacity Calculation Regions

Capacity calculation regions are to be designated across Europe. The calculated available capacity will be used as an input in a complex computer algorithm to match bids and offers for electricity across all connected markets in Europe, with the aim of maximising economic surplus.[57] CACM states that by three months after entry into force, all TSOs shall develop a common proposal for capacity calculation regions.[58]

Interviewees involved in the development process of CACM, stated that the current draft includes proposals for a region involving UK and Ireland, and a "Channel" region for UK to the continent. Seven interviewees pointed out that allocating capacity on a regional level, rather than the current interconnector-by-interconnector level, would create significant issues for merchant interconnectors who operate across a border between capacity calculation regions. As operational safety limits for the calculation region would be defined system-wide, rather than for each individual interconnector, the available capacity offered to the market is likely to be less than the maximum capacity of both interconnectors, thus constraining the ability of the merchant interconnectors to sell capacity as they see fit, in favour of welfare maximisation across the wider European system. For the UK, this could see the capacity of the IFA and Britned interconnectors (and NEMO and NSN Link, when they are built) constrained, reducing revenues. Two interviewees expressed concern that removing the ability of merchant developers to sell their full capacity how they see fit could be fatal to the merchant approach. It could also

[53] The interviewees from OFGEM have requested that it is made known that the views expressed in this document are provided informally and do not represent the views of the senior management team or the gas and electricity markets authority.

[54] Recital 4, Regulation (EU)2015/1222

[55] Recital 6, Regulation (EU)2015/1222

[56] Article 14(1)states that by 3 months after the entry into force of this Regulation all TSOs shall jointly develop a common proposal regarding the determination of capacity calculation regions.

[57] Article 36, Regulation (EU)2015/1222 states that NEMOs shall develop both a price coupling and a continuous trade matching algorithm, for the day-ahead and intraday timeframes

[58] Article 15(1), Regulation (EU)2015/1222

be detrimental to developers moving forward, with uncertainty surrounding the amount of available capacity making it hard to accurately develop a long-term business case for a new project.

Capacity Calculation Methodology

Similarly to the regions, the methodologies for calculation of capacity are also in development. CACM mandates that they should be ready for approval ten months after the approval of the aforementioned capacity calculation regions.[59] However, rather than the aforementioned NTC approach, CACM is clear that the Flow-Based Method (FBM) for calculating capacity should be used, unless TSOs are able to demonstrate the competent regulatory authority "would not yet be more efficient compared to the coordinated NTC approach and assuming the same level of operational security in the concerned region".[60] The author feels that the inclusion of 'yet' here is significant, implying that even if the NTC approach is shown to be more efficient, any exemption from using the FBM would likely be temporary. With CACM having the aim of harmonising rules across Europe, this lack of leeway is perhaps to be expected. The FBM differs from NTC because whereas NTC relies on ex-post redispatching to alleviate congestion, FBM allocates capacity ex ante according to the actual availability of capacity on the network. Karova mentions that the technical complexity associated with developing flow-based calculations have thus far lead to slow progress in implementation (Karova, 2011). The EC already has reservations about the NTC method. NTC was used by SvK to calculate capacity available for export from the Swedish market. The aforementioned EC Decision argued that the NTC capacity calculation framework they used allowed them to set "too-high" transmission reliability margins and thus reduced the capacity available for transactions to avoid expensive domestic congestion. Based on the precedent set by this Decision, it could be argued that any future decision on the appropriate methodology in any given context would take into account the perceived risks of the NTC approach.

The capacity made available by each region in Europe will form an input into an algorithm specifically designed to "match bids and offers in an optimal manner".[61] This algorithm will work on the principle of allocating capacity to maximise economic surplus across the coupled markets. According to theory, FBM works to optimise efficiency of capacity calculation and allocation across Europe based on a more precise calculation method that takes into account that electricity can flow via different paths in interdependent grids (CREG et al, 2015). Whilst the NTC approach relies on 'redispatching' to alleviate congestion, the FBM only allows for flows to be scheduled based on the actually available capacity. This method selects exchanges from different zones thereby allowing an efficient use of the transmission network, thanks to the aforementioned algorithm which is designed to allocate capacity and maximise welfare. The FBM has recently been tested in the Central West Europe (CWE) region of France, Germany, the Netherlands, Belgium and Luxembourg, where the methodology has been running as a parallel to normal operations since 2013 to help develop understanding. The aim has been to demonstrate the advantage of the Flow-Based methodology to help strengthen the case for its practical implementation in the CWE region (CREG 2015). The test has thus far found that welfare across the region had increased, although the benefits were unevenly distributed between the different Member States.[62] To put it simply, the average price across the CWE

[59] Article 20(2), Regulation (EU)2015/1222

[60] Article 20(1), Regulation (EU)2015/1222, with the exception rule defined under Article 20(7)

[61] Recital 4, Regulation (EU)2015/1222

[62] For the full paper, see (CREG, Autoriteit Consument & Markt, Bundesnetzagentur, E-Control, & Commission de Regulation de l'energie, 2015)

regions had dropped, but some countries ended up paying more, with others paying less. Such arrangements may be unpopular and difficult to implement across Europe, with electricity prices of national significance politically.

Interviewees also brought up a concern that the FBM may have a negative impact on the merchant model, similar to that described above in the section on capacity calculation regions. Should it be decided that the FBM is the chosen capacity calculation method, as is likely due to the preference stated in CACM, there may be yet further constraints on the owners of interconnectors to sell capacity by their own volition. This is because the algorithm that works out which flows are optimal in terms of welfare maximisation may lead to a situation whereby within each group of bidding zone borders, flow across one bidding zone border can be restricted to increase the flow on another. For example, flow across the Britned interconnector could be constrained because the algorithm finds that another flow elsewhere in Europe would create more welfare. Thus, whilst social welfare across Europe is maximised, the ability of merchant interconnectors to have control over their revenue and recover costs is severely hampered. As mentioned, these methodologies are still in development. OFGEM acknowledged that the uncertainty created during the development period could create challenges for developers, particularly in light of the concerns over the FBM. Both the uncertainty and the potential downsides mentioned could continue the 'de facto' chilling effect mentioned by Cuomo and Glanchant and further constrain the space for merchant development in Europe (Cuomo & Glachant, 2012). More research and modelling needs to be done in order to take into account how the FBM will impact on the merchant business model. Martella and Francke argue that in policy areas such as the environment the EU functions as a form of federal government, with more than 80% of environmental protection laws set in Brussels (Martella & Francke, 2012). Whilst it should not be a surprise, with it being almost 20 years in the making, the IEM and the implications for national governments is something that federalist scholars from a legal and political science background should revisit.

5.4.3 Day-Ahead Market Coupling

Market coupling refers to the process of linking different energy markets together to create a larger market, dependent on their being sufficient transmission capacity to allow for electricity to be traded (ENTSO-E, n.d.). This is a key facet of the Internal Energy Market. The EU envisages this happening for a range of different time frames, which link to a range of different 'products'. CACM discusses the day-ahead and intraday timeframes, the Forward Capacity Allocation (FCA) Code refers to forward markets and the Electricity Balancing (EB) Code provides rules for the balancing market, which is in development. In the long run, the vision is for market coupling to replace explicit auctions in the day-ahead timeframe.

Day-ahead markets allow for buyers and sellers in a designated market area to trade electricity to be delivered the following day. This could be in a national market or a regional market, as is the case with the Nordpool market for Scandinavia and the Baltic region. In the case of Elspot for the Nordpool region, this trading is driven by the needs of these buyers and sellers. For example, a utility may assess how much energy it will need to meet demand the following day, and how much it is willing to pay for this energy, hour by hour. The seller, for example the owner of a hydroelectric power plant, needs to decide how much he can provide and at what price, hour by hour. These needs are reflected through orders entered by buyers and sellers into the Elspot trading system (NordPool, 2015). Whilst supply and demand are the main drivers for hourly prices, availability of transmission capacity also plays a role. NordPool states that "bottlenecks can occur where power connections are linked to each other, if large volumes need to be transmitted to meet demand" (*ibid.)*. In this case, prices will rise to reflect demand. The EC acknowledges that a lack of transmission capacity, both internally and cross-border, is a significant barrier to the completion of the IEM and that significant investment is needed (European Commission, 2015c).

Non-market based methods such as bilateral contracts between Member States used to be the predominant method of cross-border capacity allocation in Europe (Mäntysaari, 2015). This was the case with the IFA interconnector between France and the UK. CACM builds on legislation from the Second and Third Package respectively, requiring market-based methods for the allocation of capacity with an emphasis on implicit auctions.[63] [64] [65] Thus, due to the aforementioned legislation, much of Europe's day-ahead markets are already coupled to some extent, with transmission and power implicitly allocated. However, as mentioned, there remain barriers to the effective functioning due to a lack of transmission capacity. In 2014, the South-Western Europe (SWE) and North-Western Europe (NWE) regions were linked, meaning that electricity can be traded from Portugal to Finland (APX.com, n.d.). This now operates under a common day-ahead power price calculation, with prices varying according to regional congestion. Thus, CACM aims to further develop this project, with Eastern Europe still working to develop the capabilities that will allow it couple to their markets (ENTSO-E, 2014b). The wider coupling of markets will operate using EUPHEMIA (EU Pan-European Hybrid Electricity Market Integration Algorithm) (PCR, 2014). This algorithm is designed to maximise social welfare across Europe. A larger market means greater liquidity, more competition and less volatile prices, which leads to an increase in welfare and an efficient price allocation (PCR, 2014). Some interviewees have pointed out that in testing, the algorithm failed to converge, leading to questions about its ability to optimise flows in light of the large amount of complex information it tries to account for. There are also reservations about such an algorithm being able to account for the AC network in Europe and HVDC interconnectors, which operate in fundamentally different ways. However, should the whole of Europe be coupled together, it could provide interconnectors with access to new customers, should they be competitive on price. Developing this hypothesis further is outside the scope of this thesis, although more research into the actual benefits market coupling to interconnectors would be a valuable area for future research.

5.4.4 Intraday Market Coupling

CACM mandates that European markets are coupled in the intraday timeframe.[66] Similarly to the day-ahead timeframe, NEMOs are responsible for developing proposals for this in conjunction with TSOs, with national regulatory authorities responsible for authorising the proposals.[67] Also similarly to the day-ahead markets, some intraday market coupling already exists in Europe. Thus, CACM mandates the completion of this integration. One interviewee from the power exchange, APX, stated that NEMOs voluntarily began this task in advance of CACM entering into force with the development of the XBID algorithm, which will be the common system for intraday trading of electricity in Europe. This algorithm is designed to maximise economic surplus for the intraday market timeframe.[68] CACM states that capacity in the intraday timeframe should be allocated using *continuous* implicit allocation.[69] Implicit capacity

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[63] Article 6(1) Regulation (EC) 1228/2003 on Conditions for Access to the Network for Cross-Border exchanges in electricity

[64] Article 12(2) of Regulation (EC) 714/2009

[65] Recital 13, Regulation (EU)2015/1222

[66] Article 1(1), Regulation (EU)2015/1222

[67] Article 7, Regulation (EU)2015/1222

[68] Article 51(1), Regulation (EU)2015/1222

[69] Recital 13, Regulation (EU)2015/1222

means that electricity *and* transmission capacity are bought together in one product, rather than in two separate products as is the case with explicit trading. A continuous market allows for buyers of electricity to update their positions inherited from the day-ahead timeframe and react to changing demand in close to real time, which is important for managing the variable nature of supply offered by increasing amounts of renewable energy (Pointvogl, 2013). Currently, intraday trading happens in an auction, where batches of orders (to buy or sell electricity) are grouped together then executed at the same time. Thus, price formation occurs over a period of time and is not continuous or instantaneous. Under a continuous process, a transaction is made each time a buy and sell order meet in price (Marien, Luickx, & Tirez, 2014). One interviewee expressed concern that continuous trading may have an impact on price formation, with both an increasingly liquid market and continuous allocation reducing the scarcity of the product.

One interesting aspect for both the day-ahead market discussed above and the intraday market discussed here, is the inclusion of an article on 'maximum and minimum prices'.[70] NEMOs are responsible for determining these harmonised maximum and minimum market prices in coordination with TSOs, in line with Articles 41 and 54.[71] A proposal on this should be developed 18 months after entry into force.[72] NEMOs are the designated power exchanges for each country, such as APX, or Nordpool Spot. When asked about these maximum and minimum prices, one interviewee involved with the drafting process stated that they would be set 'arbitrarily high or low' and represented an attempt to provide limits for the system and the algorithm to work within, rather than set to influence the market. However, with recent developments in markets leading to the occurrence of negative prices, and different power exchanges (and thus NEMOs) having different rules on whether they are allowed or not, harmonising this is both important and potentially complicated (see Benedettini & Stagnaro, 2014). Negative prices occur when there is too much generation for the system to handle. This can be the case when there is significant renewable generation matched with inflexible baseload supply which cannot be shut down, combined with low demand from consumers. The price represents the fact that the generator is willing to pay someone to consumer electricity – quite a bizarre concept. The implications of the decision on negative pricing could have an impact on the business case for interconnectors. In theory, excess generation could be used efficiently elsewhere, if there was sufficient transmission capacity to transport it (or a battery to store it, but that is a discussion that is outside the scope of this paper). Thus, negative prices show the market that there is insufficient flexibility, which can be provided by further interconnection. Further market coupling should reduce the propensity for negative prices, as access to markets increases and thus so does the number of prospective buyers who are willing to pay for the excess generation. As long as maximum and minimum prices are indeed set arbitrarily high then this should not be an issue. However, with the methodologies still to be developed and no clear picture, this uncertainty could also impact on interconnector developers.

5.4.5 Firmness of Capacity

CACM states that both day-ahead and intraday cross-zonal capacity should be classed as 'firm' to allow for effective cross-border allocation.[73] Firmness is defined as a guarantee that cross-border capacity rights will remain unchanged and that compensation is paid if they are changed,

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70 Articles 41 and 54, Regulation (EU)2015/1222 for day-ahead and intraday respectively

71 Article 7(c), Regulation (EU)2015/1222

72 Articles 41(1), Regulation (EU)2015/1222

73 Recital 17, Regulation (EU)2015/1222

for example due to a fault.[74] In layman's terms this means that should an interconnector fail, for whatever reason, the owner is responsible for compensating the buyer for the lost capacity. CACM states that TSOs are responsible for developing a proposal for a single day-ahead firmness deadline not to be shorter than half an hour before the day-ahead market gate closure time.[75] Intraday capacity is to be considered as 'firm' as soon as it is allocated, due to the implicit nature of intraday products.[76] Interviewees associated with market design acknowledged that this level of firmness at the intraday timeframe is vital to the success of the model for market coupling in the IEM. One interviewee stated that prior to CACM the compensation regime for interconnectors was generally set at between 100-110% of the price paid for the capacity at auction, also known as 'Initial Price Paid'. However, interviewees acknowledged that there will be a new regime for firmness compensation in CACM. The new regime would see the compensation level set at the spread between the market prices, which could lead to significantly higher costs than the previous regime. With HVDC interconnectors there is a monthly cap to this cost. Generally, interviewees were in agreement that this could be a threat to the merchant business case, although one interviewee stated that this is just one part of the wider business model - something that of course has to be taken into account although a wider review of all aspects that impact on business case was outside of the scope of this study. What is clear is that curtailments can be extremely costly, running into millions of Euros if capacity is not restored quickly. CACM states this cost can be recouped by network tariffs, thus being passed on to consumers.[77] Whilst this would apply to regulated interconnectors, for merchant interconnectors who cannot recover costs through network charges this cost will be taken out of revenue – a cost that it could be argued further harms the business case for the merchant approach, particularly if the rewards in terms of profits are already heavily regulated. Under the cap-and-floor regime, OFGEM stated that if these costs contribute to taking the project below the floor level of revenue then the interconnector would be able to top up revenue through network tariffs, meaning that consumers would also be liable for this new regime. The implications of this are further discussed in Chapter 6.

Some interviewees also expressed concern about firmness in the case of *force majeure* events.[78] In these cases, the firmness compensation regime is less severe, returning to the 'Initial Price Paid' regime which could lead to differing impacts on the parties concerned.[79] In the event of a disagreement from a TSO, an assessment of whether the event constitutes a *force majeure* takes place ex-ante, led by the concerned NRA.[80] Despite the fact that Mäntysaari states that "*force majeure* events are defined so narrowly in the CACM Framework Guideline that they should be rare" (2015, p. 564), interviewees felt that what constitutes such an event was open to interpretation and thus could be subject to dispute with a lack of consistency a potential issue for project developers.

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[74] Article 2(44), Regulation (EU)2015/1222

[75] Article 66, Regulation (EU)2015/1222

[76] Article 71, Regulation (EU)2015/1222

[77] Recital 23, Regulation (EU)2015/1222

[78] Article 2(45), Regulation (EU) 2015/1222 defines a *force majeure* as "any unforeseeable or unusual event or situation beyond the reasonable control of a TSO, and not due to a fault of the TSO, which cannot be avoided or overcome with reasonable foresight and diligence, which cannot be solved by measures which are from a technical, financial or economic point of view reasonably possible for the TSO, which has actually happened and is objectively verifiable, and which makes it impossible for the TSO to fulfil, temporarily or permanently, its obligations in accordance with this Regulation".

[79] Article 72(3), Regulation (EU)2015/1222

[80] Article 72(5), Regulation (EU)2015/1222

5.4.6 Cost Recovery

This section will focus on the recovering the costs of development and implementation of CACM, with other costs, such as ensuring firmness of capacity, discussed in their respective sections.

Alongside the potential to impact on revenue, the development of methodologies and the implementation of CACM will create costs for TSOs and interconnectors. The regulation states that any costs incurred setting up processes to comply with CACM should be assessed by the relevant national regulator, OFGEM in this case, and if reasonable and proportionate, recovered via network tariffs or appropriate mechanisms as decided by the "competent regulatory authority".[81] Tasks for TSOs include; working together to develop, validate and implement the central capacity calculation algorithm for intraday and day-ahead coupling and developing a methodology for the cost sharing of redispatching and countertrading within capacity calculation regions.[82] Furthermore, they are required to provide a contribution to NEMOs to help them recover the cost of establishing, amending and operating single day-ahead and intraday coupling as well as any costs for developing inputs to provide data for their grid model and the subsequent merging of these into the common grid model.[83]

Whereas interconnectors built under the regulated model will be able to pass these costs onto consumers through network tariffs, as stipulated, that is not an option for merchant interconnectors who recover costs through the collection of congestion rent. Thus, the crux here is what will be deemed as an appropriate mechanism for cost recovery and what costs are deemed acceptable by the 'competent regulatory authority'. The author argues that in the British context this would be OFGEM, as they are the designated NRA. In an interview OFGEM acknowledged that under the merchant model costs are recovered through congestion rent rather than network tariffs, and that this would need to be considered when assessing costs and establishing appropriate mechanisms for cost recovery. A lack of clarification on this position, or any issues that arise when OFGEM do assess what costs are acceptable, could likely add to the 'de facto regulatory chill' effect on merchant interconnectors, as discussed by Cuomo and Glanchant in relation to the conditions placed on the BritNed interconnector which effectively curtailed their ability to maximise profits (2012). With the semi-regulated cap and floor regime allowing some costs to be passed on to consumers should revenues drop below the floor, there is further chance for some cost to be passed on. This will be discussed in more detail in Chapter 6.

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81 Article 72, Regulation (EU)2015/1222

82 Article 8, Regulation (EU)2015/1222 and Article 71(1), Regulation (EU)2015/1222

83 Article 73(2), Regulation (EU)2015/1222 and Article 75 (1) & (2), Regulation (EU)2015/1222

6 The Merchant Approach in the UK

This chapter thus looks to answer research question 2; why does the UK favour a merchant approach? The first part of this chapter provides an analysis of the context of the merchant approach, focusing on the case of the UK. With the rest of Europe preferring a regulated model to interconnector development, the author sought to investigate why the merchant approach was justified. This analysis is categorised according to aspects of legitimacy, effectiveness and efficiency. This work provided the base for Chapter 7, which then looks at the prospective impact of CACM on the merchant approach, reflecting on the same aforementioned aspects.

6.1 Legitimacy

As mentioned in the literature review, the principle driver for the merchant approach in the UK is that the energy regulator, OFGEM, believes that it is the approach that offers the best value for consumers. OFGEM have the final say on regulatory decisions related to energy. Thus, barring a change in the law, from a feasibility point of view the merchant approach is the only politically acceptable and legitimate approach for the UK. In 2012, OFGEM began a review of the regulatory landscape for transmission through the Integrated Transmission and Planning Review (ITPR) project. This reviewed the regimes that governed transmission system planning and investment for onshore, offshore and interconnector infrastructure (OFGEM, 2013b). The aim was to develop an understanding of whether the existing regimes were likely to ensure the long term development of the overall transmission network in an efficient, coordinated manner in light of the challenges posed by increased renewable generation and a move to a decarbonised energy system (OFGEM, 2013b). The review process encompassed discussions with stakeholders from the industry and lasted for around two years. An analysis of this review process would be a lengthy undertaking and is outside of the scope of this thesis. In 2015 OFGEM concluded that a for-profit approach whereby developers brought forward interconnector projects in response to price signals was beneficial to consumers as the price signals provide incentives for efficient cost and risk management (2015, p. 5). This merchant approach is to be underpinned by the cap and floor regime discussed in Chapter 4.5, unless an exemption from EU regulation was sought and granted. The literature review provided evidence that the EU favours the regulated approach and is setting increasingly stringent requirements for exemptions. Thus, the cap and floor regime looks set to be the most politically acceptable way for merchant projects to move forward as the EU has yet to overrule a decision for an interconnector to be built using it. This implies that they feel that it is sufficiently 'regulated'. The impact of CACM on this regime is discussed further in the sections below.

6.2 Effectiveness

There have been no new interconnectors built in Britain since the BritNed interconnector was completed in 2011. As discussed above in the Chapter 4.3.2, the decision of the EC to cap the profits but not the losses left developers unconvinced – profits were constrained but risk was not. Further to this, CACM retains the restrictions on how capacity could be sold, set out in the Annex of Regulation 714/2009 meaning that long-term contracts for capacity (which offer security to developers) are forbidden unless an exemption is granted. Thus, based on this it could be easy to question the effectiveness of the merchant approach in terms of the development of new interconnection. However, as pointed out by OFGEM in the interview, since the roll out of the cap and floor regime there has been no shortage of merchant developers coming forward, with five projects now in development. This is shown in Table 6 which lists the new interconnectors in the pipeline in the UK. Thus, while the 'pure', unregulated approach seems to have been curtailed by the EU, the cap and floor regime appears to make the merchant approach more viable and looks set to lead to the further development of interconnection for the UK. This is because it provides developers with certainty surrounding returns, whilst also underwriting some of the risk – something that both interviewees and literature have highlighted as being a key issue with the BritNed decision (Cuomo & Glachant, 2012; Kessel et al., 2011; Rubino & Cuomo, 2015). Whether these interconnectors are completed remains to be seen – the development process for interconnectors is lengthy and this development is responsive to changes in business case or regulation. This is exemplified by the Imera project mentioned in Chapter 4.3.1 – despite being granted an exemption by the EU in 2008, the project does not appear to have progressed (Rubino & Cuomo, 2015). It will be important to research both interconnectors that are completed under the cap and floor regime and those which are cancelled to develop an understanding of the barriers and drivers for interconnection. However, questions remain as to whether the cap and floor is a 'merchant' approach. Whilst developers are still for-profit, profits are subject to increasing regulation, with the cap and floor business model more in line with the traditional regulated model applied to transmission infrastructure both in the UK and Europe. What is clear is that at the moment, the cap and floor-based merchant approach seems to be an effective way for developers to bring projects forward, at least in the case of the UK. The progress of these projects will be interesting to follow. However, as OFGEM state, at present there is "no central view to opine on or determine what the optimal levels of interconnection are for GB, under the current arrangements. The merchant approach therefore aims to maintain elements of market exposure which should help to guide developers on the appropriate location, size and timing of the proposed investment and minimise exposure of consumers"(OFGEM, 2013a, p. 4).

6.3 Efficiency

As mentioned above, OFGEM believes that a for-profit approach to interconnection development is the most efficient as it leads to a scenario where the public receives the benefits of new interconnection at the lowest cost. This is because they believe that a competitive space for interconnection leads to developers putting forward efficient projects, with an incentive to ensure that costs are minimised. Under the 'pure' merchant approach the project risk would be borne by the developer, as was the case with the Britned merchant interconnector, completed in 2011. However, under the cap and floor regime some risk would be borne by the consumer; should revenues for the project fall under the floor price costs will be passed on in the form of network tariffs (OFGEM, 2013a). This is significant; as mentioned in the literature review and above, the costs associated with interconnector development are high. Furthermore, any issues with operation and maintenance can be costly, particularly for subsea cables. For example, the Moyle interconnector between Scotland and Northern Ireland was out of operation from October 2011 to February 2012 and is now running at half capacity as further repairs are underway and expected to be completed in 2016 (bbc.co.uk, 2015). At the time of the curtailment, any forward contracts for capacity that have been bought would have to be honoured by owner; the cost of which depends on the contractual arrangement. Further to this, the cost of repairs was expected to exceed £31million. This is in contrast to the regulated approach, whereby all investments are regulated as part of the traditional asset base and thus all costs are passed on to consumers in network charges.[84] There has been debate in literature as to whether a competition or monopoly approach to investment in transmission infrastructure is more efficient, with general agreement that electricity transmission is most efficient as a natural monopoly (Baldwin et al., 2011; Joskow & Tirole, 2005; Philipson & Willis, 2006). As has been discussed above in Chapter 4.4, a natural monopoly arises when the market is served most cheaply by a single firm, rather than by several competing firms (Baldwin et al., 2011). However, this literature also treats interconnectors in the European sense, assuming that they are extensions of the grid and thus also best served by the monopoly firm. In a seminal paper

[84] However, these costs may be offset by reductions in electricity prices through access to new markets. However, they could also lead to higher energy prices should the interconnector couple the market to somewhere with higher prices, as one interviewee pointed out has been the case with Norway.

investigating merchant transmission investment, Joskow and Tirole argue that most literature does not make the distinction between what they class as 'network deepening' and 'network expansion' investments (2005). As mentioned in Chapter 4.4, *deepening* investments are classed as upgrades or maintenance to existing infrastructure – only feasibly undertaken by the incumbent owner for practical reasons. *Expansion* investments are classed as any new spending on infrastructure, such as cross-border interconnection. The author argues that this distinction is important, particularly when considering the differing risk profile of these investments. Joskow and Tirole argue that in theory, the merchant model can be applied to network expansion investments. However, they find that it would be unwise to rely on a purely merchant model to secure such investment as it ignores too many important attributes of transmission networks and the behaviour of transmission owners and system operators (2005). That being said, they acknowledge that in some cases the regulated approach may be less effective than a merchant model in driving innovation and investment, or ensuring that development happens in the most efficient and cost-effective manner. It appears that by and large, EU TSOs and regulators also agree with the theory that transmission networks are a natural monopoly and that interconnection fits into that, without the acknowledgement of the difference between deepening and expansion investments and the different profile of these investments. To expand the point on risk profiles, for many continental European TSOs interconnection investments will look markedly different to those from the UK or Ireland. The majority of investment in cross-border transmission infrastructure in continental Europe may require a cross-border over ground cable.[85] Interconnectors are already deemed to be expensive, with many barriers to development, but the UK is arguably a different case. As an island, all cables are subsea, increasing both the cost and risk of the project. The 2014 TYNDP by ENTSO-E stated that of the €150 billion investment in infrastructure required by 2030, €50 billion would be for subsea cables (2014a, p. 12). As the majority of European borders on the continent are land-based, the fact that a third of the required investment is earmarked for subsea projects can give an indication of the differing costs for overland and subsea interconnection. This higher cost and different risk profile arguably justifies the decision by OFGEM to exclude them from the Regulated Asset Base and open the space up to competition. However, with the majority of new projects in the pipeline being developed under the cap and floor regime, some costs may now be passed onto consumers should the revenue drop below the floor level.

In the regulated approach, consumers pay for new interconnection through increased network tariffs, which should be set at a level which facilitates the investment needed to create a functioning internal market (Kessel et al., 2011). This essentially mandates that the incumbent TSOs should be responsible for developing the right amount of interconnection for the completion of the IEM, not just focussing on the national grid. However, with these projects being risky and costly, TSOs have thus far appeared reluctant to move projects forward at a sufficient rate – something that was recognised by the EU when they mandated the creation of ENTSO-E and made them responsible for providing the network development plans (TYNDPs) and deciding on priority Projects of Common Interest (PCI). Furthermore, European TSOs and regulators may see improving the national grid as the priority, rather than cross-border interconnection, particularly as costs have to be passed onto consumers. When funds for investment are scarce, this conflict of interest could lead to cross-border interconnection losing out in favour of strengthening national infrastructure. In addition, the regulated approach leaves more room for influence from national policy or government intervention. As Trichakis and Parail argue, since governments and national regulators value consumer welfare above that of producers, and consumers on both sides of

[85] Of course, there are exceptions, as with the recently constructed €700 million Santa Llogaia – Baixàs power line that crosses the Pyrenees at the Albera massif, doubling the connection between Spain and France from 1400MW to 2800MW.

an interconnector do not always benefit from cheaper electricity prices, the agreement of two governments on an interconnector may be difficult to obtain (Trichakis & Parail, 2013). One interviewee pointed out that with the benefits of the interconnector not equally distributed, agreements about who pays and how revenues are to be split can be difficult to reach. Whilst it was outside of the scope of this study, developing a better understanding of the access to capital of European TSOs would be interesting to further develop a picture of where there is a space for merchant developers to offer projects. This allows for reflections on the efficiency of the merchant approach in comparison to the regulated approach, both in theory and in the complex, context-specific case of practice in Europe.

Regarding which model leads to the most efficient allocation of resources, the answer is clearly highly context specific. However, with much of the EU operating under a regulated approach and also seeing an underinvestment in cross-border transmission infrastructure, leading to the continued fragmentation of energy markets (see, for example European Commission, 2015) it could be argued that more of a space needs to be developed for encouraging merchant investment, rather than hamstringing it. This is consistent with Joskow and Tirole's conclusion that "an important research challenge is to develop good regulatory mechanisms to apply to regulated TSOs that *also provide opportunities for merchant investors to develop projects when they are the most efficient options*" (2005, p. 262, emphasis added). It appears that OFGEM's cap and floor regime is in line with this, although the prevailing European viewpoint is not. The question remains as to whether European TSOs would also benefit from opening up (or further opening up in the case of those with existing merchant links) cross-border transmission investment to competition. The author argues that applying the theory of natural monopoly for investment in national transmission infrastructure is logical. However, larger international investments arguably need to be looked at through a different lens.

7 The Impacts of the Network Code on Capacity Allocation and Congestion Management on the Merchant Approach to Interconnector Development

This chapter will seek to answer RQ3, building on the work of Chapter 5 to hypothesise about how CACM may impact on the merchant approach to interconnector development. It does this by building on the section above, providing analysis structured according to the impact of CACM on the legitimacy, effectiveness and efficiency of the merchant model respectively.

7.1 Legitimacy

As discussed above in Chapter 6.1, the cap and floor regime looks to be the most politically acceptable approach to bring developments forward in the case of the UK. This semi-regulated regime appears to offer developers more certainty than the merchant exemption route, whilst reducing risk to consumers. To summarise the most pertinent effects of CACM identified in Chapter 5: a review of bidding zones is expected; methodologies for capacity calculation and cost recovery are still in development and; firmness costs look set to be passed on to developers. Thus, CACM looks set to augment costs and add further uncertainty to the business case for new interconnection under the merchant approach. This could make it harder for developers to secure investment as well as to accurately calculate projected costs and revenues. This would make it harder for OFGEM to justify awarding a cap and floor regime, which relies on project costs remaining within a pre-defined limit to ensure that the exposure to consumers is minimised and projects are incentivised to be economically efficient. Regarding the future legitimacy of the regime, OFGEM conceded during an interview that some regulatory alternatives to the cap and floor approach may require legislative change but that this would require robust justification and would be a matter for government to consider. With the ITPR review in 2015 concluding that OFGEM favour a developer-led approach, something that was also echoed in the interview, a change of approach in the near term seems unlikely. However, should the impacts of CACM lead to a situation whereby developers fail to see the benefits of developing new interconnection, even within the context of the cap and floor regime, the legitimacy of the approach would come into question – particularly if the level of interconnection was thought to be insufficient to realise the benefits of the IEM to UK consumers, as defined by OFGEM. Should this happen, new incentives to improve the business case may have to be introduced. Whilst developing a robust theory as to what these incentives may be is outside of the scope of this thesis, the Electricity Balancing Code (EB) contains details of plans for a new European balancing system that will allow TSOs to respond to demand through access to a more competitive, pan-European market for balancing services (see ENTSO-E, 2014b). With interconnectors having the capabilities to provide access to such services, both in terms of balancing energy and reserves, there may be a space to improve business case. However, with the balancing market naturally volatile and unpredictable, building a business case that relies on revenue from providing such services may be difficult. As mentioned in Chapter 4.5, the author could find no independent academic research on the cap and floor regime; most likely due to the fact that no project has been constructed and entered operation under the regime. It will be interesting for researchers to focus on the regime, looking at the number of applicants and the number of projects that are granted the regime by OFGEM. Further research could seek to understand the experiences of these projects as the move from the planning to development stage to identify barriers and understand if these are regulatory or market-based. Whilst CACM and the Third Energy Package have an impact on business case, it of course also important to acknowledge that for merchant projects, price differentials are generally the driver. As (or rather, if) more interconnection develops and available cross-border capacity increases, prices between markets are expected to further harmonise and thus reduce the arbitrage opportunity for new interconnectors. Understanding the impact on this will be important in the future, should further interconnection be required in a scenario with limited price differences. This may change the landscape and alter whether this approach remains politically viable in the future.

7.2 Effectiveness

Chapter 6.2 outlined that whilst no interconnector has been built under the merchant approach since 2011, there is a pipeline of projects in development under the cap and floor regime. Thus, it is argued by the author that the merchant approach can be seen to be effective. Furthermore, it is clear that more interconnection is a priority for both the UK and the EU. However, as summarised above in Chapter 7.1, CACM is likely to lead to range of risks and increased costs for interconnectors. Whilst regulated interconnectors can recover these costs through network tariffs, merchant interconnectors will see the costs as reductions in revenue.

The new firmness regime, which will require merchant interconnectors to use revenue to cover the cost of any curtailment (with a cap set for a maximum of a month's revenue in the case of HVDC lines), presents a significant risk to the business case for current interconnectors and future developers. Under the regulated approach, these costs are passed on to consumers through network tariffs. The majority of interviewees agreed that this regime will increase costs for merchant developers and thus lead to a situation whereby it is harder for merchant developers to attract finance, although there was a lack of consensus as to the impact of these costs. However, OFGEM pointed out that for projects developed under the cap and floor regime, any costs incurred from guaranteeing firmness in the case of a curtailment will be counted when revenue is assessed. Should the costs take the interconnector below the floor level of revenue, OFGEM will provide additional funding through network charges making this a de facto regulated approach. However, whilst in a fully regulated model *all* firmness costs can be passed on to consumers, under the cap and floor only the revenue below the floor level will be recompensed. With the business model for interconnectors inversely affected by more interconnection (as supply for capacity increases the congestion rent falls), and an increased likelihood of higher costs due to the new firmness regime, one side effect could be that in the longer term, more UK-based interconnectors would pass below the floor level of revenue and require OFGEM to allow for revenue to be topped up through network tariffs. In turn, that reduces the incentive for OFGEM to grant projects a cap and floor regime, which could lead to less interconnection being developed and reducing social welfare gains at both an EU and UK level. Whilst the cap and floor regime is not the only route to development (Eleclink has secured an exemption decision), it remains the most secure for developers and therefore appears to be the most effective.

Further to the firmness regime, the capacity calculation methodology has the potential to constrain the ability of merchant interconnectors to sell capacity, with capacity allocated centrally through an algorithm designed to maximise welfare across Europe. As discussed above, the methodology is yet to be set, although the preference for the Flow-Based Method is clearly stated. Interviewees have pointed out that this regulatory uncertainty could further impact on the appetite of developers to push ahead with projects, further reducing the effectiveness of the merchant approach. As one interviewee put it, with 18 months to decide on the methodology and further uncertainty surrounding congestion income, it would be hard to go to a bank for finance with a clear picture of a business case. Thus, with regulatory considerations already significant for developers, further uncertainty is unlikely to have a positive effect. However, regardless of the final method, an interviewee from NGET remarked that taking away the ability of developers to sell their own capacity would be the 'death knell' for the merchant approach. The overall aim of the EU legislation introduced over the past 20 years has been to liberalise markets, reducing barriers to trade and allowing for the development of further interconnection to help realise a functioning internal market for energy. Despite this context, CACM could provide further barriers for merchant developers.

It is important to emphasise the importance of having a larger market to sell capacity to, as would be the case under CACM and the IEM. This could improve the business case for new regulated interconnector developments. However, generally interviewees agreed that the negative impact of the firmness regime and the uncertainty surrounding further costs associated with capacity calculation could lead to a situation whereby merchant developers would either find it harder to access finance or to justify financing a new development. With CACM further increasing the regulatory burden on merchant developers 3 interviewees expressed concern that it could be the final nail in the coffin for the merchant approach, with new routes to secure investment needed.

7.3 Efficiency

As outlined in Chapter 6.3, the merchant approach can be seen to be efficient insofar as it can facilitate development at the lowest cost to the consumer.

The merchant approach in its 'pure', current form means that no risk and no costs are passed onto consumers, with developers taking the full upside risk of the project. The 'pure' merchant approach would see such a developer rewarded with the ability to maximise profit, although as discussed in Chapter 4.2., this is no longer the case; developers are subject to an increasingly stringent regulatory regime. However, as discussed above, CACM is likely to lead to a number of costs for developers which would impact on the business model. In a scenario where market conditions are favourable (high and constant price differential), this may not have an impact on profit, should the project be subject to a cap, such as with Britned or the new projects being developed under the cap and floor regime. This is because revenue over the cap level must be reallocated to consumers, as stipulated by the conditions of the cap imposed on it by the EU in exchange for allowing it to be exempt from the TPA regime (European Commission, 2013). It is also valuable to look at a scenario with less favourable market conditions, such as may occur when there is more interconnection. In this case, for existing projects such as Britned the cost would be felt by the developer. In the case of projects developed under the cap and floor, the cost would either reduce revenue, impacting on profitability, or if it reduced revenue below the floor cap, be passed onto consumers through network tariffs. As discussed above, the recently developed cap and floor regime will lead to shortfalls in revenue being met through network charges, thus leading to costs being passed on to consumers. As discussed above, CACM is likely to increase costs and uncertainty for merchant developers, at least until capacity calculation regions and methodologies for allocation are developed, finalised and implemented. From an efficiency point of view, the impact of CACM is also likely to be negative as it increases the chance of costs being incurred which would then be passed on to consumers.

8 Discussion

As has been noted above, both a market design and sufficient transmission capacity are required for there to be a functioning IEM. This Chapter aims to answer research question 4; how will CACM affect the development of the Internal Energy Market? This chapter is divided into two parts. The initial section presents a discussion of the implications of CACM, in terms of the progress it makes towards the implementation of the IEM. It draws upon the prior chapters, with discussion structured according to the impacts on market design and infrastructure development. The second section provides some reflections and discussion on the methodology used for research and analysis.

8.1 Discussion of the Implications of CACM for the Completion of the Internal Energy Market

It is widely recognised that both market design and infrastructure are vital to the completion of the IEM; without a functioning market with harmonised rules there cannot be effective trading and without sufficient transmission capacity, both internal and cross-border, there cannot be a liquid market for electricity. This section will present a discussion on the impacts of existing EU legislation and the prospective impact of CACM on these two factors.

8.1.1 Market Design

Despite it being the latest development in over 20 years of legislative interventions by the EU, it could be argued that the CACM Network Code is actually a starting point, with much work required to implement the Code and actually deliver the IEM in a functioning form (Pointvogl, 2013). As Glanhant and Ruester remark the process is not yet finished and is likely to continue to be subject to many adverse dynamics (2014). Creating an integrated electricity market across different EU Member States is a demanding task, requiring access to interconnection and the integration of transmission and energy markets, as well as other associated transmission and ancillary services (Boucher & Smeers, 2002). Add to this the differing state of transmission infrastructure, the desire for national governments to retain a sovereign power of their energy market, the differing designs of markets and the differing state of unbundling across Member States and it is easy to see why the journey towards a single market for electricity has been (and arguably continues to be) a long and arduous one. The Network Codes, of which CACM is a vital part, thus represent the first steps towards a finalised market design, with harmonised rules – a vital facet of the single market, if it is to develop. As Howarth and Sadeh remark, competition in the energy sector remains very limited in most Member States and consumer prices vary significantly, with very long-term contracts (10–15 years) between the suppliers and consumers still common (2010). CACM thus builds on the Third Package and continues to address such issues.

That CACM represents progress is clear. As has been discussed above, the harmonisation of methodologies for capacity allocation and congestion management is important for a functioning IEM. However, it may be the case that like the First Package in 1996, CACM is merely the starting point of a longer process of cajoling Member States into implementation and progressively tweaking and improving legislation. A key difference between CACM and the First Package is that energy is now part of the legal remit of the EU meaning that intervention can be more effective. Still, the question remains one of 'how long will this take', and what will the impact be on proceedings in the meantime. As discussed in Chapter 5.4., some regional integration has already taken place, thanks to the introduction of Electricity Regional Initiatives (ERI) for the creation of Regional Electricity Markets (REMs) in 2006; an intermediate step between the national markets and the single IEM (Carvalho Figueiredo & Pereira da Silva, 2013). Of these REMs, the Nordpool market is acknowledged as the best developed of these initiatives

(Moselle, 2008). However, doubts remain over some contentious aspects of CACM and the ability of the legislation to further integrate these REMs into a singular one.

For one thing, there could be significant political barriers from Member states. Squicciarini et al. argue that the shift from a re-dispatching model of congestion management to an implicit auction model has significant economic and political implications, with Member States likely to be reluctant to implement implicit auctions for domestic congestion management (2010). Moving from a model whereby there is one price country-wide to one where different areas (or zones) pay different prices for electricity could be politically unpopular, as was the case when bidding zones were introduced in Sweden leading to customers on either side of a zonal border paying very different prices for electricity, despite their similar geographical location. These bidding zones were introduced after the Svenska Kraftnät case (discussed above in Chapter 5.4.6) as a result of EU competition law (De Hauteclocque & Hancher, 2011). Since 2011, Sweden has been divided into four bidding zones that resulted in structural price differences between the north and south, with prices in the south higher due to the distance from the cheap hydropower that supplies the north of Sweden, and the cross-border flows between Germany and Denmark (Mäntysaari, 2015). Whilst theory states that designing these borders to increase competition and stimulate investment in generation and transmission infrastructure can increase social welfare, the distributional aspects of this reallocation of welfare can be difficult to justify politically, particularly to those in the south who now pay more for their electricity than those in the north. However, bidding zones that reflect scarcity and congestion are a key part of the IEM. The results of the review of bidding zones will be of paramount importance to the IEM moving forward. Future research into the impacts of the bidding zones, should they be redesigned, will be important. Balancing the design between effectiveness and political acceptability will be important for the IEM going forward.

Furthermore, Carvalho Figueiredo and Pereira da Silva found that whilst the market coupling mechanism used by the CWE model reduced price spikes, it will also lead to price convergence, potentially creating a situation whereby "congestion revenue under implicit auctioning might decrease to a point where the interconnection cost allocation needs reviewing" (2013, p. 5). Dealing with this poses issues for both merchant and regulated interconnectors, although it is arguably more pertinent for merchant developers. The issue of harmonising prices is also politically difficult for those EU countries where electricity prices are low. Whilst outside the scope of this thesis, the implications of congestion management for price harmonisation, and what that means for interconnection development, will be important to research in the future.

8.1.2 Creating Conditions for Investment

The author argues that CACM represents clear progress towards the market design aspect of the IEM. However, it could be argued that the conditions for investment in the required transmission infrastructure are still not in place, particularly in the case of the merchant approach. Whilst the market design is important for facilitating cross-border trade, the market itself can only function efficiently if there is the required network infrastructure. As ENTSO-E acknowledge, the majority of the projects outlined in the 2014 TYNDP that have entered the permitting process have experienced delays (2014a). This means that the grid development required to facilitate the targeted renewable energy integration by 2030 is unlikely to be completed in time (ENTSO-E, 2014a). This is because "at present, many stakeholders support grid development to facilitate the changes within the energy system, while those stakeholders directly impacted by proximity to new lines or new plants show a lower level of acceptance for the new infrastructure. This lack of acceptance, in addition to lengthy permit granting procedures, regularly results in commissioning delays" (2014a, p. 15). Whilst it is in its early stages of implementation with many aspects still to be finalised, 8 out of 11 interviewees expressed concern that CACM would have a detrimental effect on interconnection development under the merchant approach. With the EU acknowledging that there is underinvestment in infrastructure this conclusion seems surprising. There is a clear intent to support interconnector development on the part of the EU, exemplified by for example; the TEN-E Regulation and PCI's; the establishment of ENTSO-E and their biannual Ten Year Network Development Plan (TYNDP); the recent communication from the European Commission to the Parliament on achieving the 10% interconnection target (2015) and; the commitment from President Juncker towards the European energy union (European Council, 2015). However, when you analyse the previous EU position on merchant interconnection and take into account that the Third Energy Package and the decision to cap the profit of BritNed effectively halted investment in interconnectors in the UK, the developments outlined in CACM do not seem surprising, merely a continuation of the EC position. The danger is that CACM continues or exacerbates the 'de facto chilling effect' discussed by Cuomo and Glanchant in relation to the exemption approval process (Cuomo & Glachant, 2012). This thesis does not claim that the UK approach is the only effective way for interconnectors to be developed, nor that Europe could and should move to a merchant approach – clearly neither is the case. Indeed, with the merchant approach the black sheep in the context of European interconnection development, the question of 'why should people in Brussels care' is indeed valid. The EU fears that merchant developers distort competition, or undersize projects to maximise congestion rents – the author agrees that these fears are based on sound logic. Furthermore, the fact that much of Europe operates under a regulated approach can create further barriers to development and a lack of understanding of the merchant approach. However, with interconnection in Europe hitting economic and regulatory barriers, any approaches that lead to developing the additional interconnection that is clearly needed should at least be understood and at best be encouraged. The apparent lack of pragmatism from the EC displayed by the severe limitations they place on merchant developers seems ill advised. If there are potential costs and risks associated with merchant interconnection, there are also clearly significant costs associated with not having enough cross-border capacity. The benefits of new interconnection, in light of the current lack of investment, are surely greater and require a more nuanced approach than the current restriction. Whilst the additional PCI funding has been given to merchant projects, it appears to be a case of 1 step forward, 2 steps back. With the EU in need of investment, the worrying aspects of CACM may lead to developers reconsidering or financiers questioning whether the investment is likely to be the best allocation of their funds. Furthermore, with this study providing an insight into how the merchant approach can provide new interconnection in a competitive space, at least cost to consumers – all things that the EU sees as targets of the IEM – the question becomes 'why'?

Four interviewees, two of which had a hand in the drafting process for CACM, expressed that the merchant approach was little understood by European TSOs who all treat interconnectors as part of the Regulated Asset Base. With a consensus on the regulated approach, there is little appetite for the merchant model, nor incentive for understanding it. This is significant because the drafting process for Network Codes is undertaken by TSOs, as outlined in Chapter 3.6.1. One interviewee, who was on the drafting team for CACM, expressed surprise that merchant developers had not been more vocal during the drafting process. The interviewee's assertion was confirmed by an independent developer from the FAB Link project who admitted to having an understanding of some of the implications of CACM but that they as developers did not work to influence the drafting process. Further to this, the UK TSO who are part of the ENTSO-E drafting group are National Grid Electricity Transmission (NGET); a legally separate business from the arm of National Grid responsible for interconnection development. This is as per regulation stipulated by OFGEM, which, as discussed, regulates profits from NGET under a different model to that of interconnectors. Thus, the aims and interests of NGET (System Operation) are different from that of the interconnector business – something which interviewees with National Grid pointed out as being a barrier to influencing the development process. This lack of understanding is augmented by the fact that for the UK, interconnection is a different prospect. It requires expensive, subsea cables as opposed to building a new line across a border. For efficiency reasons, these cables are also HVDC, which can create difficulties as they need to be controlled in a different way to the meshed AC network in much of Europe (Policy Exchange, n.d.). This provides further difficulty when addressing issues of design. Despite this, interviewees from OFGEM pointed out that as the GB NRA and Chair of the ACER Electricity Working Group they had been heavily involved in the development of the Network Codes and feel that alongside the completion of the IEM, the outcome as a whole would be beneficial to UK consumers.

Overall, it is clear from the interviews that developers are worried about the cost of assuring firmness and the uncertainty surrounding the methodological developments on bidding zones, capacity calculation and cost recovery. They will need assurances that they will be able to recoup the costs that befall them, should it transpire that there are costs to be passed on. A failure to do so could see a reduction in appetite from UK developers, even under the auspices of the cap and floor. These impacts could also see a reduction in the desire of OFGEM to award cap and floor regimes moving forward, should the drop in revenue be significant enough to impact on the business case. This finding is cateris paribus; of course there are other aspects of the business case that are important to interconnectors. However, as discussed, a full analysis of these wider aspects was outside the scope of this thesis. What is also clear is that CACM is continuing to push Member States towards a more regulated approach. What is perhaps surprising is that given the EU view on competition and free markets, this is the direction they are taking, particularly when the appetite for merchant development can provide a solution that does not pass costs onto consumers, or in the case of the cap and floor, reduces exposure for consumers. Furthermore, whilst in theory a fully merchant developer may strategically 'underinvest' in capacity to maximise congestion rent, rather than social welfare, the benefit to consumers from having that interconnector are still higher, in social welfare terms, than with not having the interconnector at all.

8.2 Discussion of Methodology

This section will present an evaluation and some reflections on the methodological approach used by the author.

8.2.1 Methodological Approach

The methodological approach used for this thesis has been appropriate insofar as it has allowed the author to: firstly develop an understanding of the context surrounding CACM via a literature review; secondly to develop an understanding of the text itself through a legal analysis and; thirdly to discuss the implications with expert stakeholders. This was an iterative, rather than a linear process – the literature review was ongoing and the author revisited the text of CACM after interviews to re-assess assumptions. In their paper analysing the regulatory practices that are used to progress the IEM, Hancher and de Hautecloque state that "the three EU Regulations and the two EU Directives that constitute the Third Legislative Package make for dense reading, and untangling the complex relationships that should or could evolve between the different players is a demanding exercise" (2010, p.319). Whilst the author has only delved into three of the Third Package texts, alongside CACM (supplemented by some reading of the FCA and EB codes), he feels that it is important to echo that sentiment and acknowledge that aspects may have been missed in this review. Indeed, with CACM being such a complex text, the reflections provided by expert stakeholders have been invaluable to this thesis. The implications of CACM are in many cases still to be seen, and understanding the technical, economic and legal implications has required a steep learning curve. Any interpretations derived from the text and interviewees are the responsibility of the author, as are any mistakes or misunderstandings. Whilst the author has attempted to get a range of perspectives there could have been room for further interviews to bring in the perspective of a TSO from continental Europe, or from policy makers at the EC. Whilst not essential to the study, being able to confirm first-hand the (oft reported, and by credible sources such as energy expert David Newbery; see (Policy Exchange, n.d.)) assertion that the merchant approach is not well understood in continental Europe through an interview with a regulator or TSO would have been a valuable context to add. Thus, whilst a wider range of interviews would have been beneficial to further validate the study, overall the author feels that the methodological approach and choice of methods has been sufficient for achieving the research aims and objectives.

8.2.2 Choice of Evaluation Model and Criteria

The author feels that the flexibility offered by the MCA evaluation model has justified its use. Whilst a CBA or ex-ante impact assessment would have been valuable, the resources needed to undertake such studies meant that they were unsuitable for this project. The availability of quantitative data would also have been a hindrance, which also justified the use of the MCA. However, the author acknowledges a qualitative, exploratory study such as this will lack replicability for other researchers.

The selection of indicators was made based on data availability and value to the study. They were used to both develop an understanding of the merchant approach and then to understand the impact that CACM may have on this approach. Initially, the author chose four evaluation criteria for analysis; legitimacy, effectiveness, efficiency and equity. As the research progressed, the author felt that little additional value was added through the equity section, with the possibility to cover the relevant points in the other three sections. The evaluation of these criteria is of course subjective, and the author acknowledges that this impacts on the replicability of the study. Whilst the use of more quantitative-based indicators would have increased the replicability, little empirical data available due to both the early implementation and the nature of CACM. Furthermore, as the study set out to be exploratory in nature, providing a snapshot of the unique picture prior to the implementation of CACM, the author feels that the more qualitative nature is justified.

9 Conclusion

This study sets out to investigate the potential impact of the Network Code on Capacity Allocation and Congestion Management on the merchant approach to interconnector development, and what this may mean for development of the Internal Energy Market. This chapter will conclude the findings of the research according to the research questions stated in Chapter 1.3. These are: What are the different approaches to interconnection development?; Why does the UK favour a merchant approach?; How will CACM affect the merchant business model for interconnection development?; and How will CACM affect the development of the Internal Energy Market?

9.1 Main Findings and Conclusions

This thesis has found that alongside the more well-known 'merchant' and 'regulated' approaches to interconnector development, a third semi-regulated model has emerged in the shape of the cap and floor regime. This approach is more in line with the regime that governs investment in internal transmission grids, with profits regulated. However, whilst the regulated approach is generally managed by a monopoly TSO, private developers remain the initiators of cap and floor interconnector projects. The floor price level allows for a level of certainty for merchant developers following the BritNed Decision of 2007, which capped profits but did not set a floor for losses. This resulted in a loss of confidence in the merchant approach and what Cuomo and Glanchant termed a "de facto chilling effect" on merchant transmission investment (2012). Following the development of the cap and floor regime it now looks set to become the de-facto route to investment for merchant projects in the UK. The majority of projects in the pipeline are proceeding under this approach, with the exception of the Eleclink project, which has received an exemption Decision from the EC.

Following a comprehensive review process between 2013 and 2015 OFGEM have concluded that the merchant approach represents the most effective and efficient way for new interconnection to be developed in the case of the UK. As the British energy regulator, their support for this approach provides it with the legitimacy needed to bring projects to market. The merchant approach has proven itself to be effective, as shown by the extensive pipeline of projects in development in the UK; in stark contrast to much of the rest of the EU where a lack of interconnectors is widely recognised to be a significant barrier to a functioning IEM. Furthermore, OFGEM argue that it represents the best value for UK consumers, with the subsea interconnectors essential for linking markets to the UK both risky and expensive. Crucial to the development of UK interconnectors moving forward is the cap and floor regime, which reduces the exposure of consumers to the failings of projects. The merchant approach is different from the predominant model in Member States, where interconnectors are treated as part of the traditional transmission grid, developed by the monopoly TSO with income regulated as part of the Regulated Asset Base. This is in line with the theory that grids should be seen as a natural monopoly. The author argues that in the context of the UK, the risk profile of projects is arguably different from that of continental Europe. Thus, an approach where competition is welcomed and projects are 'for-profit' is seen as more efficient in order to achieve investment and minimise the cost and exposure to UK consumers.

According to a reading of the regulatory text and interviews with stakeholders, there is a cause for concern that CACM may lead to a) an increase in costs being passed onto merchant developers without clarity on how they can be effectively recovered and b) further uncertainty surrounding the merchant approach to development due to the period of development for methodologies relating to capacity calculation and bidding zones. The uncertainty over methodological developments and the resulting impact on business case may extend the 'regulatory chill effect' cited by Cuomo and Glanchant (2012) in relation to the EU's exemption Decision to cap the profits of the Britned interconnector in 2011.

There is no doubt that CACM represents progress towards the completion of the IEM; harmonising rules for capacity calculation and congestion management have long been mooted as an essential aspect. Thus, it is important to highlight these developments and the fact that, in theory, the internal market should lead to gains in social welfare for EU consumers, benefits to security of supply, and facilitate further penetration of intermittent renewables which will lead to environmental gains through a reduced reliance on fossil fuels. Furthermore, there remain significant differences in the implementation of unbundling regimes in different Member States which could hamper competition on an EU-wide scale. Thus, the gains associated with having access to a larger market may not be realised until long into the future, particularly with many politically contentious issues such as the redefinition of bidding zones, capacity calculation methodologies and cost sharing agreements to be decided on. With the business case for interconnectors already difficult to predict, the uncertainty that CACM will herald in may be a further boon to investors. As there are already significant barriers to interconnection development in the EU, the attitude towards the merchant approach does not appear pragmatic. Whilst a purely merchant approach may lead to developers under sizing cables in order to increase producer surplus at the cost of social welfare, the semi-regulated cap and floor approach developed by OFGEM and CREG offers a pragmatic solution that allows investors to make a profit whilst reducing the exposure and cost to consumers. Thus, whilst there are struggles to develop and build projects in much of Europe, the UK has a large pipeline of projects that could double capacity by 2020, meeting the EU target of 10% of installed capacity by 2020. However, the uncertainty and costs that CACM may impose could lead to business cases worsening. Whilst the interconnector business case is based on myriad other factors, of which CACM is only one, it is clear that CACM is likely to make merchant interconnection in the UK more difficult, rather than less. Whilst the cap and floor regime clearly goes some way to appeasing developers and financers, a situation where a project requires revenue to be topped up to reach the floor price is not in the interest of those stakeholders, nor the UK consumer who will ultimately pay for this through network tariffs. OFGEM, in their role as regulator, will have to assess these costs and benefits as more information comes to light. The author feels that the semi-regulated cap and floor regime could offer a route to development for interconnectors in other areas of Europe, subject to regulatory approval in the respective Member States. This could help to relieve the constraints on capacity that are currently facing Europe, as market developers would look to propose projects. With ENTSO-E looking to prioritise developments and bring a more centrally planned approach to identifying bottlenecks in the EU transmission system, this method could allow for projects to be financed using outside investment rather than national funds. Some interviewees expressed concern that CACM could represent the final nail in the coffin for the merchant approach. Whilst this study cannot confirm or deny that claim, the fact that stakeholders are expressing that belief does not bode well for the EU, nor the UK, both of whom clearly benefit from increased interconnection. Whilst the legal framework that CACM provides represents progress towards a market design, the further barriers it seems likely to present to interconnector developers in the UK means that it may not support the development of infrastructure. For there to be a functioning IEM, which will realise the long mooted benefits, there needs to be both.

9.2 Suggestions for Future Research

This research into the impacts of CACM is preliminary – as mentioned, there is much work to be done before methodologies are implemented and the market begins to function. This has implications for the validity of the conclusions of this study. Thus, ex-post analysis of both this development process and the implementation itself would provide valuable further commentary on the findings outlined in this study, as well as insight into the progress of the IEM. Whilst CACM has been the focus of this thesis, the other two market codes; the FCA and the EB, are likely to have impacts for both merchant interconnection development and the completion of the IEM. Understanding the impact of the Market Codes holistically would be valuable, although it was outside the scope of this thesis. Further to this, more academic work on the progress towards Network Codes would be welcome.

Experts on European law and policy such as Hancher and de Hautecloque have predicted that pan-European organisations such as ACER may lack power, reducing their effectiveness (2010). A review of the effectiveness of ACER and ENTSO-E would be timely, with an understanding of what barriers they face important to the EU as they try to remove power from national governments or powerful monopolies over to organisations such as these. Finally, and linked to this, another area of research that this body of work could contribute to is that of federalism. Whilst this angle was not explored in this thesis, it could be argued that the rise of EU legislative power over energy may impede on the sovereignty of Member States to have control over their energy industry, and could be challenged on the basis of Article 194(1) TFEU. As discussed above, this states that "Union policy on energy shall aim, in a spirit of solidarity between Member States, to: (a) ensure the functioning of the energy market; (b) ensure security of energy supply in the Union; (c) promote energy efficiency and energy saving and the development of new and renewable forms of energy; and (d) promote the interconnection of energy networks." As Hancher and de Hautecloque posit, Commission decisions on competition law could be challenged if Member States feel that it may negatively impact on their national security of supply or environmental concerns (2010). Furthermore, they mention that Article 194(2) TFEU restates the right of Member States to determine the conditions for exploiting its own energy resources, its choice between different energy sources and the general structure of its energy supply (2010). The tension between the European and national state, and which one should have the power over the energy system, is far from settled. A federalist perspective to this argument has already been offered by scholars such as Burgess, Jayanti and Trillas (2000; 2012; 2010). However, with the Network Codes and the rise of ACER and ENTSO-E creating a new context, a new study would be interesting.

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Directive 96/92/EC concerning common rules for the internal market in electricity

Directive 2003/54/EC Concerning common rules for the internal market in electricity

Regulation 1228/2003/EC on conditions for access to the network for cross-border exchanges in electricity

Directive 2009/72/EC Concerning common rules for the internal market in electricity

Regulation (EC) 713/2009 establishing an Agency for the Cooperation of Energy Regulators

Regulation (EC) 714/2009 on conditions for access to the network for cross-border exchanges in electricity

Consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union 2012/C 326/01

Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure

Regulation (EU) 2015/1222 establishing a guideline on capacity allocation and congestion management

Appendix I: List of Interviewees

Date	Organisation	Type	Description
30-Jun	NGIC- EBD	Personal	National Grid; European Business Development department
08-Jul	NGIC- EBD	Personal	As above, different interviewee
08-Jul	NGIC- NRB	Personal	National Grid; Non-Regulated Business Department
22-Jul	NGET	Personal	National Grid Electricity Transmission; regulated TSO, separate company from those listed above
28-Jul	Eirgrid	Phone	The Irish TSO. It is a state-owned commercial company
31-Jul	DECC	Phone	The Dept. for Energy and Climate Change of the UK Government
04-Aug	EWIC	Phone	East-West Interconnector Company; owned by Eirgrid
05-Aug	DECC	Phone	The Dept. for Energy and Climate Change of the UK Government- different interviewee from above
11-Aug	TI	Phone	Representative of the FAB Link Project
11-Aug	APX	Phone	Representative of APX, a major European power exchange, who worked on the development of XBID
11-Aug	OFGEM	Phone	The UK energy regulator, responsible for consumer welfare. The organisation worked to develop the cap and floor regime, and to draft the Network Codes

Appendix II: List of companies with a stake in current or prospective interconnectors in the UK

Party	Description
Agder Energi	Power company based in Agder, Norway. It is the second largest power producer in Norway.
E-co	Power Company based in Norway. The City of Oslo owns 100 % of the parent company, E-CO Energi Holding AS
Eirgrid	The Irish TSO. It is a state-owned commercial company
Elia	The Belgian TSO. A regulated legal monopoly.
Element Power	Private investor in renewable energy projects. Portfolio includes Europe and America, but with a focus on the Northern European market.
Energinet.dk	The Danish TSO for electricity and natural gas. It is an independent public enterprise owned by the Danish state under the Ministry of Climate and Energy
Groupe Eurotunnel	Manages and operates the Channel Tunnel between Britain and France, which could hold an interconnector cable without further engineering work
Landsvirkjun	The Icelandic national electricity generator, owned by the Icelandic state. Processes 75% of electricity used in Iceland
Lyse	Lyse is a electricity, infrastructure and telecommunications company based in Jæren and Ryfylke, Norway
Mutual Energy	A company which manages strategic energy assets in the long term interests of Northern Ireland's energy consumers. It has no shareholders so financial surpluses are for the benefit of energy consumers
NGIC- National Grid Interconnectors Limited	A subsidiary company of the National Grid PLC, established for the development of interconnectors. Separate from the regulated part of the National Grid, with profits unregulated.
NGIH- National Grid Interconnectors Holdings Limited	
NGNLL- National Grid NEMO Link Limited	
NGNSNLL- National Grid NSN Link Limited	
RTE- Réseau de Transport d'Electricité	The French TSO. A regulated monopoly. Originally part of EDF, although has been separated due to the EU unbundling regime
Star Capital	STAR is an independent investment fund manager with over €1 billion of equity funds under management.
Statnett	The state owned Norwegian TSO
TenneT	The Dutch TSO, with activities in the Netherlands and Germany
Transmission Investment	TI work with investor partners to develop, acquire and manage transmission assets such as interconnectors
Vattenfall	The Swedish state owned power company, with operations in Denmark, Finland, Germany, the Netherlands, Poland, and the United Kingdom

Appendix III: Copy of the Participation Information Sheet provided to interviewees

Participant Information Sheet

M.Sc. thesis researching the impact of the EU Network Code on Capacity Allocation and Congestion Management (CACM) on the merchant approach to interconnector development

My research aims to develop an understanding of how CACM is likely to impact on merchant interconnection, a development approach that is unique to Britain. To help develop this understanding it is important to speak to a range of stakeholders; developers, regulators and TSOs.

You have been selected to participate in my research because you are an expert and directly involved in the regulation of interconnectors. During this interview, I will ask you some guiding questions, which you are free to answer according to your interests and experiences. The interview will take about 20-40 minutes. Participation in this dissertation research is entirely voluntarily and you have the right to withdraw from the study at any point in time.

The research is undertaken in cooperation with Ms Hannah Kruimer from the European Business Development Department of National Grid, the UK transmission grid operator, which supports my research by endorsing me to experts and practitioners like you.

The European Business Development Department of National Grid has, however, an interest in the final results of my dissertation, since it informs the department about industry-wide business practices.

Therefore, any information, which you release to me, will be anonymized. As a consequence, it will not be possible to trace back any information or responses to any individual interview participants in the final dissertation.

I will be happy to provide you with a copy of the dissertation once it has been completed and assessed, likely to be in October 2015. The final copy will include an executive summary, should that be more convenient