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Energy Union: Key Decisions for the Realisation of a Fully Integrated Energy Market

Study for the ITRE Committee

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STUDY

Abstract

This study, provided by the Policy Department A at the request of the ITRE Committee gives an overview and analysis of the main EU policies, measures and instruments that contribute to the realisation of fully integrated and well-functioning electricity and gas markets in Europe. Detailed case studies explore capacity remuneration mechanisms, electricity market coupling, and cross-border gas trade between Hungary and its neighbours. Policy recommendations to improve the effectiveness of the integration process are formulated based on the key findings.

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LIST OF ABBREVIATIONS

ACER	Agency for the Cooperation of Energy Regulators
BAU	Business-as-usual
CAM	Capacity allocation mechanisms
CAO	Central Allocation Office
CASC	Capacity Allocation Service Company
CBA	Cost-Benefit Analysis
CEE	Central Eastern Europe
CEER	Council of European Energy Regulators
CEF	Connecting Europe Facility
CF	Cohesion Fund
CMP	Congestion Management Procedures
CO2	Carbon dioxide
CRM	Capacity remuneration mechanisms
CWE	Central Western Europe
DA	Day-ahead
DG	Directorate-General
DSM	Demand side management
EAS	ENTSO-E awareness system
EC	European Commission
EFSI	European Fund for Strategic Investments
EIB	European Investment Bank
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSO-G	European Network of Transmission System Operators for Gas
EEEF	European Energy Efficiency Fund
EIPP	European Investment Project Portal
EP	European Parliament
ERDF	European Regional Development Fund
ESIF	European Structural and Investment Funds
ETS	Emissions Trading System
EU	European Union
FTR	Financial Transmission Rights

GHG	Greenhouse gas emissions
GTM	Gas Target Model
HAR	Harmonisation of allocation rules
ICT	Information and communications technology
ID	Intra-day
IEA	International Energy Agency
IEM	Internal Energy Market
JAO	Joint Allocation Office
LIP	Local implementation projects
LNG	Liquefied natural gas
LTC	Long-term contract
MS	Member State
NC	Network Code
NRA	National regulatory authority
NWE	North Western Europe
OTC	Over-the-counter
PCI	Project of Common Interest
PX	Power exchange
R&D	Research and development
REMIT	Regulation on Energy Market Integrity and Transparency
RES	Renewable energy sources
ROC	Regional operational centre
RSCI	Regional Security Coordination Initiatives
SET-plan	Strategic Energy Technology Plan
TEN-E	Trans-European Energy Networks
TM	Target Model
TSO	Transmission System Operator
XBID	Cross-border intraday

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EXECUTIVE SUMMARY

Background

In February 2015 the European Commission introduced the Energy Union package with the aim "to give EU consumers – households and businesses – secure, sustainable, competitive and affordable energy". One of the most important pillars of the Energy Union is that the electricity and gas markets should function properly and be integrated at the European level. The internal energy market combines the free flow of gas and electricity within the EU with the necessary regulation to deal with market failures and competition issues to make it function properly. In order to achieve this objective, several directives and regulations have been adopted, which set the legal and regulatory framework; they are complemented with guidelines, recommendations, network codes, etc. to ensure proper implementation. A roadmap for the Energy Union was developed with specific actions regarding the internal energy market. At a more practical level, the completion of the internal energy market implies the full implementation of the Electricity and Gas Target Market Models that were developed as reference models.

Aim

The aim of this study is to assess whether, and to what extent, the EU's internal energy market objectives can effectively and efficiently be reached with the current policies and instruments.

The specific objectives of this research study are to:

- Describe the array of instruments in place, both at EU and national level, that support the realisation of an integrated European energy market;
- Identify bottlenecks that may affect the effectiveness of the instruments that are currently in place;
- Propose policy recommendations for further improvements.

Key findings

- The integration of electricity and gas markets provides substantial macro-economic benefits, but the regional implementation projects are delayed, mainly due to inadequate governance.
- Diverging national energy policies and market rules are hindering market integration.
- EU legislation is often not implemented in a timely or correct way and non-compliance of national legislation is not rapidly addressed by the European institutions.
- Electricity wholesale prices were increasingly converging since the market coupling, but since 2013 this trend has been negatively impacted by changes in the energy mix, and in particular by the strong development of wind and solar energy in some MSs.
- The way in which electricity markets currently function is not adapted to accommodate the increasing volumes of generation from variable renewable energy sources.

- Some electricity and gas retail markets have become very competitive and dynamic but in most MSs, consumers cannot yet fully benefit from competition amongst suppliers and market based prices.
- Interconnection capacity calculation and allocation mechanisms have substantially improved, but market function was still hindered in some MSs by non-market based allocation mechanisms.
- Interconnection levels have increased for both electricity and gas, but the available capacities are still insufficient to ensure fully integrated electricity and gas markets.
- The EU instruments targeted at co-financing energy infrastructure projects effectively contribute to realising investments, but the framework lacks focus and coherence.
- Available EU energy funding only covers about 5 % of the overall financing needs for transmission grid infrastructure.
- Security of electricity supply is mainly addressed at national level, and non-harmonised capacity remuneration mechanisms (CRMs) are being implemented with the risk of hindering the completion of the internal energy market.

Recommendations

- Integration of electricity and gas markets should be facilitated and accelerated by stronger governance at supranational/EU level and reinforced coordination and cooperation amongst key stakeholders.
- National energy policies and market rules should be more harmonised.
- EU regulation should be timely and correctly implemented by national authorities and any infringements should be rapidly and effectively addressed at EU level.
- Structural congestion and hence diverging wholesale energy prices may be used as a guiding indicator to signal a possible need for additional interconnection capacity.
- The target design model for the electricity market should be urgently implemented across Europe. This would also help to accommodate the increasing share of generation from variable renewable energy sources.
- Retail markets should become competitive and dynamic in all MSs and offer energy and related services at market-based prices.
- The commercially available interconnection capacity should be increased and its allocation should be market-based and non-discriminatory.
- Interconnection targets for electricity and gas should be underpinned by comprehensive cost-benefit analyses.
- EU funding programmes and instruments for energy infrastructure should be better aligned and be backed by a clear and harmonised framework for cross-border investments.
- EU funding for energy infrastructure should be increased and should target priority cross-border projects that contribute to market integration and security of supply.
- Power generation adequacy should be assessed at supranational level and ensured by a favourable investment climate and well-functioning electricity markets and, as a last resort, by properly designed capacity remuneration mechanisms.

1. INTRODUCTION

This chapter provides a brief introduction regarding the aim of this report, the methodology used as well as a reading guide.

1.1. Aim of this report

The aim of this study is to assess whether, and to what extent, the internal energy market (IEM) objectives of the European Union (EU) can effectively and efficiently be reached with the current policies and instruments. The study provides input and updated information on policies, measures and practices that are directly or indirectly relevant for energy market integration; it evaluates the regulatory framework and main instruments and identifies on the one hand the positive developments and best practices and on the other hand the barriers and bottlenecks for efficient market integration. Based on this analysis, key findings are formulated which mainly focus on legislation and governance.

This comprehensive assessment is also based on case studies, which contribute to achieving the objective of this study, which is to identify and formulate policy recommendations for improvements in legislation and governance that can facilitate and accelerate the transition towards a genuine internal energy market in Europe.

The specific objectives of this research study are to:

- Describe array of instruments in place, both at EU and national level, that support the realisation of an integrated European energy market;
- Identify bottlenecks that may affect the effectiveness of the instruments that are currently in place;
- Propose policy recommendations for further improvements.

This analysis will thus:

- Provide a clear identification of best practices and barriers for energy market integration;
- Provide an in-depth analysis of the success factors of the best practices and the most appropriate measures to overcome certain barriers;
- Identify key policy initiatives, challenges and possible recommendations, both horizontally as cross-cutting issues relevant to specific regions or Member States, to enhance integration of the energy market; and
- Feed into the debate regarding the role of EU coordinated and integrated energy policy.

1.2. Methodology

This study is developed on the basis of a comprehensive collection and analysis of relevant information (legislative and regulatory documents, position papers, progress reports, market analyses, studies, etc.) on the realisation of the internal energy market. The results of this analysis were validated via contacts with experts, and have allowed to identify best practices and positive developments on the one hand, and barriers and bottlenecks on the other hand.

This overall analysis is complemented with some case studies on specific topics of interest:

1) Electricity day-ahead wholesale market coupling in Central Western Europe (CWE) and Central Eastern Europe (CEE)
2) The necessity and feasibility of a European approach for capacity remuneration mechanisms in the electricity sector;
3) Impact of non-market based allocation of gas import capacity in Hungary on the gas market functioning

Based on the above mentioned analysis and these case studies, the report assesses the current policies and instruments and provides policy recommendations.

1.3. Reading guide

This report is structured as follows:

- Chapter 1 provides an **introduction.**
- Chapter 2 is **setting the scene by introducing the Energy Union and the policy context**. It describes the objectives of the EU IEM, and provides an evaluation of its main benefits and the progress made so far.
- Chapter 3 provides an overview and analysis of the **key legislation and regulatory framework (governance)** that support the transition to the IEM;
- Chapter 4 focuses on the **electricity and gas markets.** It describes their functioning and analyses the policy initiatives and measures that are being taken to foster their integration. Firstly, the functioning and cross-border integration of wholesale electricity markets are discussed; this sub-chapter is illustrated with two case studies on market coupling (CWE and CEE). Secondly, the wholesale gas market is discussed, including the implementation of the gas target model. In this context a case study on the allocation of gas interconnection capacity in Hungary is added to illustrate the importance of adequate capacity allocation mechanisms. Lastly, the current status and developments in the retail markets for gas and electricity are briefly presented.
- Chapter 5 focuses on the **transmission and interconnection infrastructure** of both gas and electricity. It discusses the main challenges regarding infrastructure and interconnection targets and evaluates the impact of the Projects of Common Interest on the interconnectivity level.
- Chapter 6 provides an overview of some key **instruments that contribute to co-financing the investments** needed to succeed the transition towards an integrated energy market in Europe. Firstly, the main EU instruments to incentivise public investments in electricity and gas infrastructure, and in particular the Projects of Common Interest are discussed. Secondly, capacity remuneration mechanisms (CRMs), that incentivise investments in electricity capacity, are briefly presented. A comprehensive case-study on CRMs is added in annex.
- Chapter 7 summarises the **key findings and policy recommendations**.
- Annex 1 gives an overview of the roadmap for integration of the IEM.
- Annex 2 provides an overview of the progress made towards the completion of the IEM.
- Annex 3 includes the case study on electricity day-ahead wholesale market coupling in Central Western Europe and Central Eastern Europe.
- Annex 4 includes the case study on the necessity and feasibility of a European approach for capacity remuneration mechanisms in the electricity sector.

- Annex 5 includes the case study on market distortion and conflict with EU regulations in Hungary as a result of non-market based allocation of limited cross-border gas capacities.

2. SETTING THE SCENE

KEY FINDINGS

The Energy Union package was introduced with the aim to provide EU consumers – households and businesses – secure, sustainable, competitive and affordable energy.

One of the most important pillars of the Energy Union is

- a properly functioning internal energy market,
- its integration at European level which should result in higher system and supply security,
- increased competition and competitiveness
- and facilitated integration of renewable energy sources (RES).

Significant progress has been made and indicators have been introduced to monitor this progress. However, substantial efforts still need to be made to succeed the completion of the internal energy market.

This chapter sets the scene by introducing the Energy Union and provides a brief overview of the policy context. It describes the aim to achieve the EU internal energy market, and its main challenges and benefits as well as the progress made so far.

2.1. The Energy Union

2.1.1. EU policy & strategy focusing on electricity and gas markets' functioning and integration

Over the last 20 years, the EU has put in place a number of policies and regulations in order to attain its major energy policy objectives: competitiveness, sustainability and security of supply. In view of enhancing competitiveness and realising the internal energy market, three key legislative packages were adopted between 1996 and 2009. After the groundwork of the first two Energy Packages, the **Third Energy Package** (2009) provided the cornerstone for the implementation of the internal energy market. In 2011 the European Council agreed on the objective to complete the internal energy market by 2014.

Other important legislative initiatives that have a substantial impact on the energy markets' functioning and integration are the 2020 and 2030 targets and related policies. In order to decarbonise the economy, the **Climate and Energy Package**, agreed upon in 2007, set targets for 2020 which should allow to reduce the overall greenhouse gas emissions in the EU by 20 % compared to 1990, to increase the share of renewables in energy consumption to 20 % on average and to reduce the EU primary energy consumption by 20 % on average compared to the business-as-usual (BAU) scenario.[1] These targets were set by EU leaders in 2007 and enacted in binding legislation in 2009. They are also headline targets of the Europe 2020 strategy for smart, sustainable and inclusive growth.

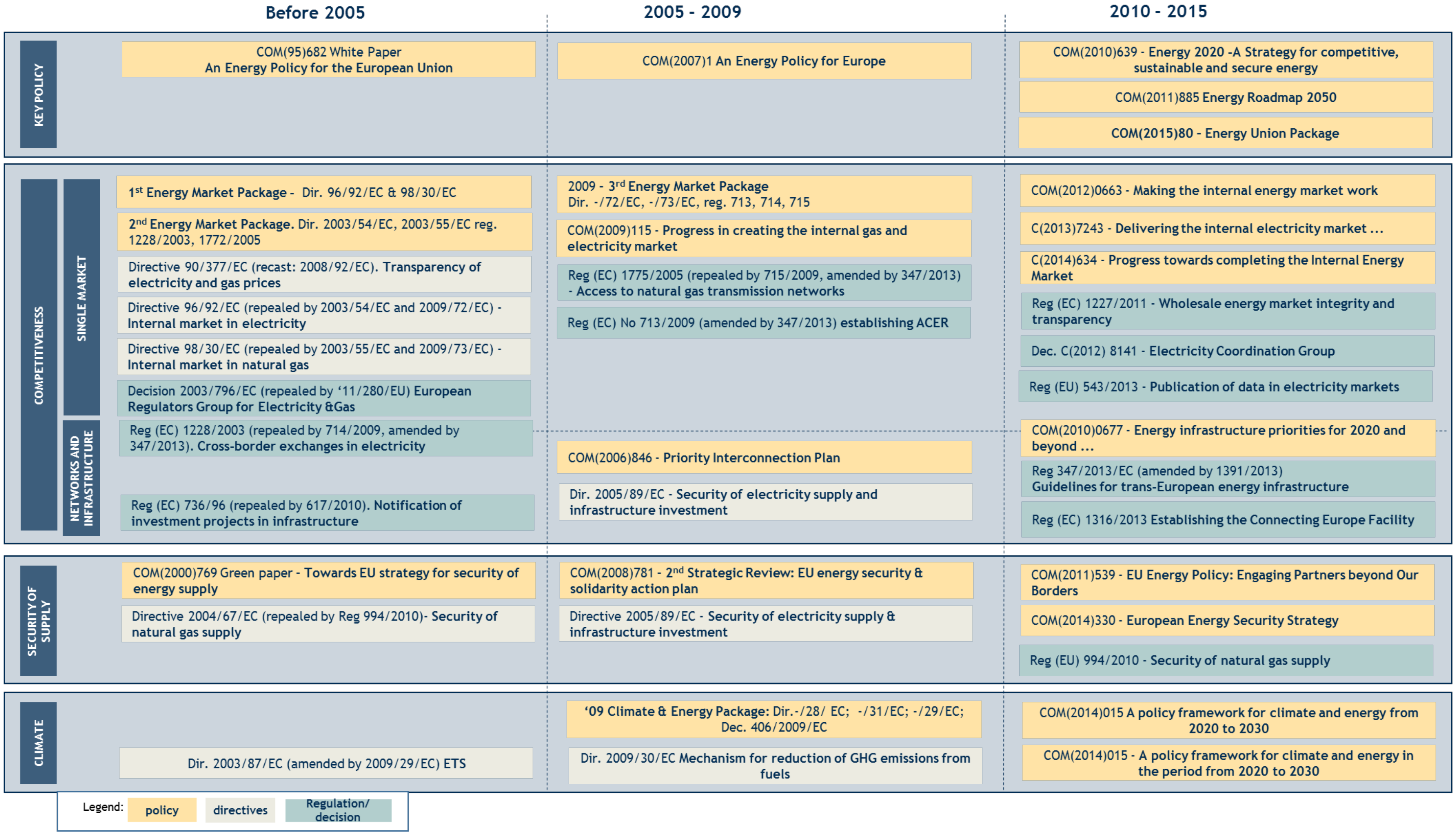
In 2014 Member States and the Commission agreed on ambitious EU targets for 2030:

- a 40 % cut in greenhouse gas emissions compared to 1990 levels;
- at least a 27 % share of renewable energy consumption; and
- at least 27 % energy savings compared with the BAU scenario.

[1] EC (2010) - COM(2010) 639 final

In the field of security of supply the 2005 **Directive on Security of Electricity Supply** and the 2010 **Regulation on Security of Gas Supply** are the most important legislative initiatives, along with the 2008 Second Strategic Energy Review and the 2014 EU Energy Security Strategy. Figure 1 provides an overview of the EU policy on the internal energy market. Key legislation is further elaborated in chapter 3.

Figure 1: Overview of EU policy on the internal energy market



Source: Author.

2.1.2. The EU Energy Union Package

In February 2015 the European Commission published a communication on the Energy Union Package "A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy".[2] The package states the goal of the Energy Union is "to give EU consumers – households and businesses – secure, sustainable, competitive and affordable energy". In order to reach these goals five mutually-reinforcing and closely interrelated dimensions were set out in the package:

- Energy security, solidarity and trust;
- A fully-integrated European energy market;
- Energy efficiency contributing to moderation of demand;
- Decarbonising the economy; and
- Research, Innovation and Competitiveness

These dimensions are not new, as the first EU internal energy markets discussions already started in the 80s. However, they are now grouped, interlinked and clearly written down in one communication with a clear identification of the way forward. The second dimension concerns the completion of the internal energy market and is the main focus of this study.

2.2. The EU Internal Energy Market

One of the most important pillars of the Energy Union is a proper functioning of the energy markets and their integration at European level. The IEM combines the free flow of gas and electricity through the EU with the necessary regulation to deal with market failure at the EU level and competition policy to make it function properly.[3] The internal energy market should not be considered as an end in itself, but an instrument to deliver "economic growth, jobs, secure coverage of the consumers' basic needs at an affordable and competitive price, and sustainable use of limited resources."[4]

In order to realise the internal energy market several directives and regulations have been adopted (see overview in Figure 1). These directives and regulations set the legal framework for the internal market and are discussed in more detail in chapter 3. Also, a roadmap for the Energy Union was developed[5] with specific actions regarding the internal energy market. An overview of the actions that are relevant for the internal energy market can be found in Annex 1.

At a more practical level, the completion of the internal energy market implies the full implementation of the Electricity and Gas Target Market Models that were developed as reference models. These models are discussed in the next paragraph, followed by the benefits of the IEM and a subsequent overview of the progress towards reaching the IEM.

2.2.1. IEM target market models

The target models for both the electricity and the gas markets are "in the process of being fixed in a framework of guidelines and network codes which specify the technical rules for

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2 EC (2015a) - COM(2015) 80 final

3 Based on EC (2015a) - COM(2015) 80; EC (2014c) - COM(2014) 330; European Council (2011); Klackenberg, Egenhofer & Gialoglou (2004)

4 EC (2012a) - COM(2012) 663

5 This roadmap was published in February 2015 with the launch of the Energy Union. An updated version was published in November 2015.

how these markets should function".[6] The goals and principles of both models are hereafter presented.

a. Electricity Target Model

The **Electricity Target Model** foresees the coupling of the different national markets into one European electricity market ensuring optimal use of cross-border transmission capacity. It includes a set of proposals and network codes based on two broad principles: (1) energy-only regional markets and (2) market coupling between the different regional markets.[7] The integration of electricity markets requires that electricity markets across Europe share a set of common features and are linked by efficient management of interconnection capacities.[8] There are however still several issues that need to be addressed to improve the electricity markets' design and functioning.

b. Gas Target Model

The **Gas Target Model** promotes price convergence via hub-based trading. In 2011, at the request of the participants of the 18th Madrid Forum, a Gas Target Model was developed by CEER[9] and published in its "Vision for a European Gas Target Model".[10] The aim was to create a coherent framework to implement the Third Energy Package in view of improving the functioning of the national markets and their integration into an EU wide internal market. This objective should be reached by creating a "competitive European gas market, compromising entry-exit zones[11] with liquid virtual trading points, where market integration is served by appropriate levels of infrastructure, which is utilised efficiently and enables gas to move freely between market areas to the locations where it is most highly valued by gas market participants".[12] The table below gives an overview of CEER's vision.

Table 1: Overview of CEER's vision on the Gas Target Model

Goal	Condition or measure
Enabling functioning wholesale markets	• Creation of entry-exit zones • Network users on the hubs have a balancing responsibility • Sufficient presence and low concentration of players, diversity of gas sources, sufficient demand for gas, sufficient ratio between the total volume of gas traded to the volume of gas consumed[13]
Connecting functioning wholesale markets	• All interconnection capacity should be available to market participants and unused capacity should be offered back to the market. Capacity should be used in such a way that gas flows

6 European Court of Auditors (2015)
7 The target model developed by the Pentalateral Energy Forum was used as a reference for the EU target model.
8 ACER (2015c)
9 At the 18th Madrid Forum CEER was mandated to establish this Gas Target Model. After consultation of the relevant stakeholders, the model was developed.
10 CEER (2011)
11 A zone where entry capacity is allocated separately from exit capacity; gas that has entered this zone can be (commercially) delivered to any exit point within the zone
12 ACER (2015b)
13 CEER has also elaborated a desirable set of parameters: churn rate > 8, Herfindahl-Hirschman Index < 2000, gas being available from at least 3 different sources, total gas demand > 20bcm, and a Residual Supply Index > 110% for > 95% of days per year.

	from low priced areas to high priced areas • Gas transmission networks owned and operated by certified TSOs to ensure non-discriminatory and efficient management • Capacity is auctioned on a central booking platform and tariffs are set in a transparent, cost reflective, non-discriminatory way promoting efficient investment • Implicit capacity allocation
Ensuring secure supply and economic investment	• Remove (implicit) destination clauses[14] and contractual paths • Signal network users' willingness to pay for additional capacity • Reduce risk of asset stranding

Source: CEER (2011)

2.2.2. Benefits of the IEM

One of the main benefits of interconnected electricity and gas systems and markets is **increased system and supply security**. In an interconnected system, energy and capacity are easily tradable across national borders, which contributes to system and supply security. Well-interconnected energy markets will also mitigate the isolation of Member States that are highly dependent on a single external gas supplier or a local power generator. With increased cross-border interconnection capacity and trade, TSOs and market operators are better able to balance supply and demand, which is indeed a major challenge with the increasing share of intermittent power generation. In a large and liquid well-integrated energy market, the costs of energy necessary to balance supply and demand are lower in principle, which means that the same security level can be reached at reduced cost, in particular if consumers are also enabled to participate in integrated intraday and balancing markets by adjusting their consumption pattern to price signals and being rewarded for their flexibility. System security can also be enhanced and/or ensured at lower cost if TSOs are allowed to contract ancillary services (reserve capacity) in interconnected neighbouring markets.

A second benefit of the internal energy market (markets' integration) is **increased competition and competitiveness**. If power generators are obliged to commercialise their output in a wider supranational market, there will not be any dominant national players anymore and individual companies will have less market power (i.e. less market concentration). Market integration and cross-border competition will also result in lower prices, as electrical energy is produced where it is cheapest[15], and will hence contribute to surpluses for consumers and producers; end users will be faced with lower energy bills and the competitiveness of the energy intensive industry will be improved. This will result in higher social welfare for the EU as a whole.

A highly interconnected energy system and integrated energy market can also better facilitate the development of **renewable energy sources**. The intermittent character of renewable energy generation can be better counterbalanced in a larger interconnection area through cross-border flows of energy. Highly interconnected energy systems are indeed more resilient to sudden changes in demand or supply.

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[14] Destination clauses are provisions that oblige the customer to use the purchased gas in its own country or sell it to other customers in the country

[15] With increased competition market players will bid based on their marginal costs.

A study published in 2013 by Booz & Company estimated that the annual net economic benefits from the completion of the integration of the electricity market are in the range of EUR 12.5-40 billion per year by 2030.[16] The same report states that gas market integration (under a scenario in which the current situation of oversupply continues) could provide a maximum benefit from gas and flexibility price effects of up to EUR 30 billion per year.[17]

2.2.3. Progress towards completing the IEM

In February 2011, the European Council stated that the internal energy market had to be completed in 2014 and that no MS should be an isolated energy island by 2015. In October 2014, the Commission published a communication on the progress towards completing the internal energy market for electricity and gas.[18] This communication stressed that there is a significant need for additional infrastructure – both to reinforce the transmission grid and to cope with upcoming challenges. It also highlighted that the adoption of common European network codes and better implementation are needed along with more effective coordination.

A summary of the progress towards completing the IEM is presented in Annex 2. According to this communication, Europe has made significant progress so far, mainly due to the implementation of the Third Energy Package, but substantial further steps need to be taken to achieve the target.

In November 2015 another communication was published by the EC that proposed indicators to monitor the progress towards meeting the Energy Union objectives.[19] With respect to the integration of the energy markets various indicators were selected and monitored. A summary of these proposed indicators can be found in Table 2.

Table 2: Relevant indicators to monitor the progress on the integration of the IEM

Indicator	Explanation	Status
Electricity interconnection capacity	The electricity interconnection capacity of a MS in relation to its total generation capacity	8 MSs are still below the 10 % target (see Figure 11 for an overview of the status in 2014)
Market concentration index for power generation	The sum of squared market shares of the three largest electricity generation companies measured in percentages of total installed capacity (Herfindahl Hirschman Index)	Market concentration in power generation remains significant in some MSs. Concentration levels have decreased over the last 10 years by 19 % on average. Most concentrated markets are in Cyprus, Estonia, Croatia, Latvia and Malta.
Market concentration index for wholesale gas	The sum of squared market shares of wholesale gas supply companies measured in percentages of total	Market concentration remains significant in some MSs. Most concentrated markets are in Estonia, Spain, Lithuania, Latvia

[16] Booz & Co (2013)
[17] Booz & Co (2013)
[18] European Commission (2014d) - COM(2014) 634
[19] EC (2015e) - SWD(2015) 243

Indicator	Explanation	Status
supply	wholesale gas supply (Herfindahl Hirschman Index)	and Slovakia.
Wholesale electricity price	Electricity prices at wholesale markets in MSs	Difference between lowest and highest price has decreased. However, large differences remain and price divergence can (temporarily) increase in future. Local market prices differ significantly from each other.
Wholesale gas prices	Average of annual gas prices in MSs	High price convergence on major European gas hubs. 'Oil-indexed' prices differ more from each other.
Annual switching rates on electricity retail markets	Percentage of final electricity consumers changing supplier in a given year	Rate is above 5 % at EU level and increasing. However, large discrepancies remain among MSs.
Annual switching rates on gas retail markets	Percentage of final gas consumers changing supplier in a given year	Rate is above 5 % at EU level and increasing. However, large discrepancies remain among MSs.
Energy poverty index	Percentage of households facing arrears on utility bills, unable to keep their home warm and/or living in homes with leakages and damp walls.	12 % of EU households can be considered at risk of energy poverty.

Source: EC (2015e) - SWD(2015) 243

The European Commission also stressed the need to monitor the N-1 rule for gas infrastructure and the implementation of the Projects of Common Interest.[20] Moreover, specific information could be added in the future on the uptake of smart grids (e.g. the extent of smart metering deployment), and an in-depth analysis is needed on indicators measuring intra-EU market coupling (e.g. price convergence across countries) and energy trade flows. Finally, additional and more comprehensive indicators for the functioning of the retail markets and energy poverty are needed.

We notice that most indicators are calculated on the basis of national figures. This approach is relevant for retail markets, which are still organised at national level. Other indicators (e.g. market concentration for power generation and wholesale gas supply) are however not fully representative anymore, as they do not take into account the impact of market integration. Market concentration can be mitigated by measures within the concerned national market (such as new entrants), but it can also be efficiently addressed by integrating national markets and by organising competition at supranational level. This evolution should be taken into account in future monitoring exercises.

[20] EC (2015e) - SWD(2015) 243

3. LEGISLATION AND GOVERNANCE AT EU LEVEL

KEY FINDINGS

Extensive legislation has been put in place since 1996 to enable the transition to competitive, well-functioning and integrated electricity and gas markets; governance bodies have been set up and assigned with specific roles and responsibilities to ensure and monitor this process.

However, the implementation process is complex and slow, and diverging national energy policies and market rules still hamper market integration and the completion of the internal energy market.

Moreover, compliance of national legislation with EU regulation is not effectively ensured and the current governance structure at supranational level is too weak to efficiently address cross-border issues.

In this chapter the key directives and regulations which are relevant in the context of the realisation of an integrated energy market are briefly described. Furthermore, the role and functioning of the main governance bodies at EU level are highlighted.

Key challenges with respect to legislation and governance are:

- To ensure that EU legislation is timely and correctly implemented in all MSs;
- To ensure a greater harmonisation of national legislation in order to facilitate the integration of energy systems and markets and to avoid market and competition distortions;
- To provide an enabling regulatory framework to (potential) investors and to remove distortive state interventions;
- To strengthen the governance instruments and processes at supranational level, in order to efficiently address cross-border issues.

3.1. Key legislation

In this chapter the key legislation with respect to the creation of a single European energy market is treated by presenting the three energy packages and providing an overview of the status of the network codes. Subsequently, the key legislation relating to the security of electricity and gas supply and the development of trans-European transport networks is briefly discussed.

3.1.1. Single energy market

In order to harmonise and liberalise the national electricity and gas markets in view of the creation of an EU wide internal energy market, three legislative packages were successively adopted by the European legislators.

a. First Energy Package

The First Energy Package, which was published in 1996 (for electricity) and in 1998 (for gas), was the first important step to gradually open up the national electricity and gas

markets, which were at that moment still dominated by national incumbents.[21] The main objective of this legislative package was the liberalisation of the electricity and gas markets, which was expected to increase the efficiency of the energy sector and lead to more competitive energy prices for both households and industries, and hence contribute to the competitiveness of the European economy as a whole.

b. Second Energy Package

In 2003, the first legislative package was replaced by the Second Energy Package which further strengthened the unbundling rules for transmission system operators and stipulated that all European non-household customers and all households had to be eligible to choose their supplier in a competitive market place as of respectively July 2004 and July 2007.

c. Third Energy Package

The main legislative basis for the energy markets' functioning and their integration is the Third Energy Package, which was adopted in April 2009.[22] Two main principles of this package that should contribute to more competitive and well-functioning energy markets are **unbundling**, which means that energy supply and generation activities should be effectively separated from the distribution and transmission activities, and **third party access,** which implies that every market party (generator, supplier, end-user, etc.) that asks for a connection and/or access to the grid should have this right on the basis of objective, transparent and non-discriminatory conditions and tariffs.

Box 1: The third energy package

The Third Energy Package, which entered into force on 3 March 2011, has not yet been fully transposed and implemented in all Member States. It included the following directives and regulations:

- **Directive 2009/72/EC** - Common rules for the internal market in electricity (effective unbundling, increased rights for consumers w.r.t. choice of supplier, stronger independence of regulatory authorities);
- **Directive 2009/73/EC** - Common rules for the internal market in natural gas;
- **Regulation (EC) 713/2009 -** Establishing an Agency for the Cooperation of Energy Regulators (ACER);
- **Regulation (EC) 714/2009 -** Conditions for access to the network for cross-border exchanges in electricity
- **Regulation (EC) 715/2009** - Conditions for access to the natural gas transmission networks.

d. European Network Codes

The Third Energy Package resulted in a mandate for the European Commission, ACER and ENTSO to develop binding European technical and commercial rules with respect to access to electricity and gas networks (network codes). The aim of this initiative is to create a level playing field for grid users across Europe and to remove barriers for energy trade between countries. In the past, these rules were made on a national or even subnational

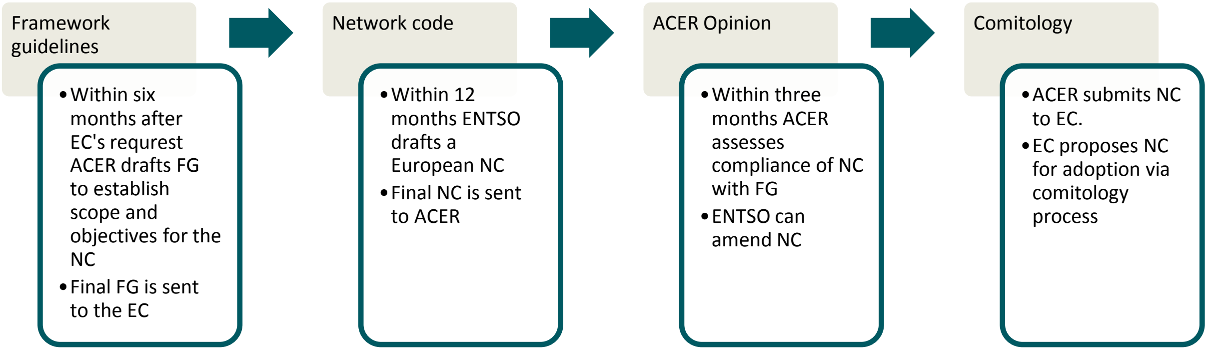
[21] Directives 96/92/EC concerning common rules for the internal market in electricity and 98/30/EC on common rules for the internal market in natural gas

[22] Directives 2009/72/EC for electricity and 2009/73/EC for gas

level. However, with an increasing interconnection capacity and energy cross-border trade, EU-wide rules are much more efficient and less distortive.

The process to develop these network codes, which was set out in the Third Energy Package, is illustrated in the figure below.

Figure 2: Process to develop network codes



Source: ACER.

Each network code requires different steps to be taken before it can be considered fully implemented, including national decisions, regional agreements and new European common methodologies. Some network codes are being adopted by MSs, before having been finally approved, in a framework of early implementation of regional initiatives. As suggested by regulators, TSOs have decided to begin the early implementation of a number of projects, as the finalisation and adoption of network codes by MSs takes time. This will contribute to faster delivery of the internal energy market.[23]

At the moment ENTSO-E, ENTSO-G and ACER are working on the drafting and approval of different network codes, which have to be implemented and complied with across Europe. An overview of the main network codes which are currently in the development, approval or implementation phase, is given in the table below.

Table 3: Development of network codes for electricity and gas

Network Code	Objective(s)	Status	Market
Capacity Allocation & Congestion Management (CACM)	Creation of a single approach to cross-border electricity trading for each time frame (forward, day-ahead and intraday) and a coordinated methodology to calculate and allocate interconnection capacity across Europe, following Flow-based Market Coupling (FBMC) as a target model.[24]	Applying from August 2015	Electricity
Forward Capacity Allocation	Facilitates development of liquid and competitive forward markets by setting out common rules regarding type and quantity of transmission rights which can be allocated, the way in which they	Comitology in July 2015	Electricity

[23] ENTSO-E (2014)

[24] Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management

Network Code	Objective(s)	Status	Market
	are allocated and the way in which holders of transmission rights are compensated.		
Electricity Balancing	More effective use of flexibility resources in Europe by setting out a series of steps to develop balancing markets at regional and eventually at European level.	Comitology begins in 2016	Electricity
Congestion Management Procedures	Prevents or reduces congestion in gas pipelines by requiring gas companies to make use of their reserved capacity or make it available to other network users	Applying from 1 October 2013	Gas
Capacity Allocation Mechanisms	Sets out harmonised auction rules, standardises cross-border capacity products in order to efficiently allocate transport capacity in transmission pipelines	Applying from 1 November 2015	Gas
Gas Balancing	Sets out balancing rules including responsibilities of TSOs and users, rules on imbalance charges, within-day obligations and operational balancing transmission systems.	Applying from 1 October 2015	Gas
Transmission tariff structure harmonisation	Defines a set of common parameters for tariff setting and sets requirements on the publication of tariff setting data to promote convergence in tariff structures, to ensure non-discriminatory and cost-reflective tariffs and to ensure a fair return to TSOs.	NC re-submitted to ACER in July 2015	Gas
Interoperability and data exchange	Aligns complex technical procedures used by network operators within the EU. Also, it aims to improve data communication between the different TSOs.	Applying from 1 May 2016	Gas

Source: ENTSO-G & ENTSO-E

The ongoing elaboration of EU wide network codes will facilitate and stimulate the integration of electricity and gas systems and markets. EU wide network codes are indeed an important and effective instrument for market integration by creating a level-playing

field, but for every network code, aligned regulatory oversight is needed in order to ensure a correct implementation and hence well-functioning integrated energy markets.[25]

3.1.2. Trans-European Networks for transporting electricity and gas

In 2013, guidelines were published for the identification of projects of common interest (PCI) and priority projects for trans-European networks (see section 5.2 for a detailed description of these projects).[26] PCIs aim to extend or reinforce the electricity and gas networks in the EU. They have priority for getting financial aid in the field of trans-European networks (Regulation No 2236/95/EC).

In February 2014 the European Council and the European Parliament adopted a proposal by the EC for a regulation that requires MSs to notify the EC of their investment projects in energy infrastructure.

3.1.3. Security of supply of electricity and gas

The European Energy Security Strategy[27] was a response to the 2006 and 2009 disruptions of gas supplies. It aims to promote resilience in the short term and to reduce dependency on specific fuels, energy suppliers and routes in the long-term. In particular, Regulation (EU) 994/2010 aims to help protect against gas disruptions by both strengthening prevention and crisis response mechanisms.

Regarding electricity, Directive 2005/89/EC establishes measures aimed at safeguarding security of electricity supply. It aims to ensure an adequate level of interconnection across MSs as well as an adequate level of generation capacity.

3.1.4. Analysis of key legislation

Although the EU energy legislation, in particular the 3rd package, has led to a more coordinated approach across Europe, national options (e.g. on unbundling, energy mix, grid access rules and tariffs, energy taxation and market rules) are still diverging and hindering market integration. Differences between national taxes, grid access rules and tariffs, levies and other charges on power generation and storage have an impact on investments and operational decisions (merit order) and distort competition between technologies and across borders.[28] Specific national measures to enhance security of supply or to stimulate the development of low carbon technologies, in particular support schemes for renewable energy and capacity remuneration mechanisms (CRMs), are another example of possibly diverging national energy policies which can lead to competition distortion and hinder market integration. Moreover, specific national interests in some MSs (protection of incumbent companies) still lead to a lack of political support for opening up the national market for international competition. Finally, diverging national market rules and preferences with regard to the market coupling design and processes are also hindering market integration.

More harmonised national policies would facilitate and accelerate the integration of markets and avoid or limit competition distortion amongst energy companies that are active in the same interconnected market. A coordinated approach, e.g. to reach the RES target, is also much more cost-efficient than diverging national policies. The European institutions should indeed ensure consistent policies, including measures to promote energy efficiency and

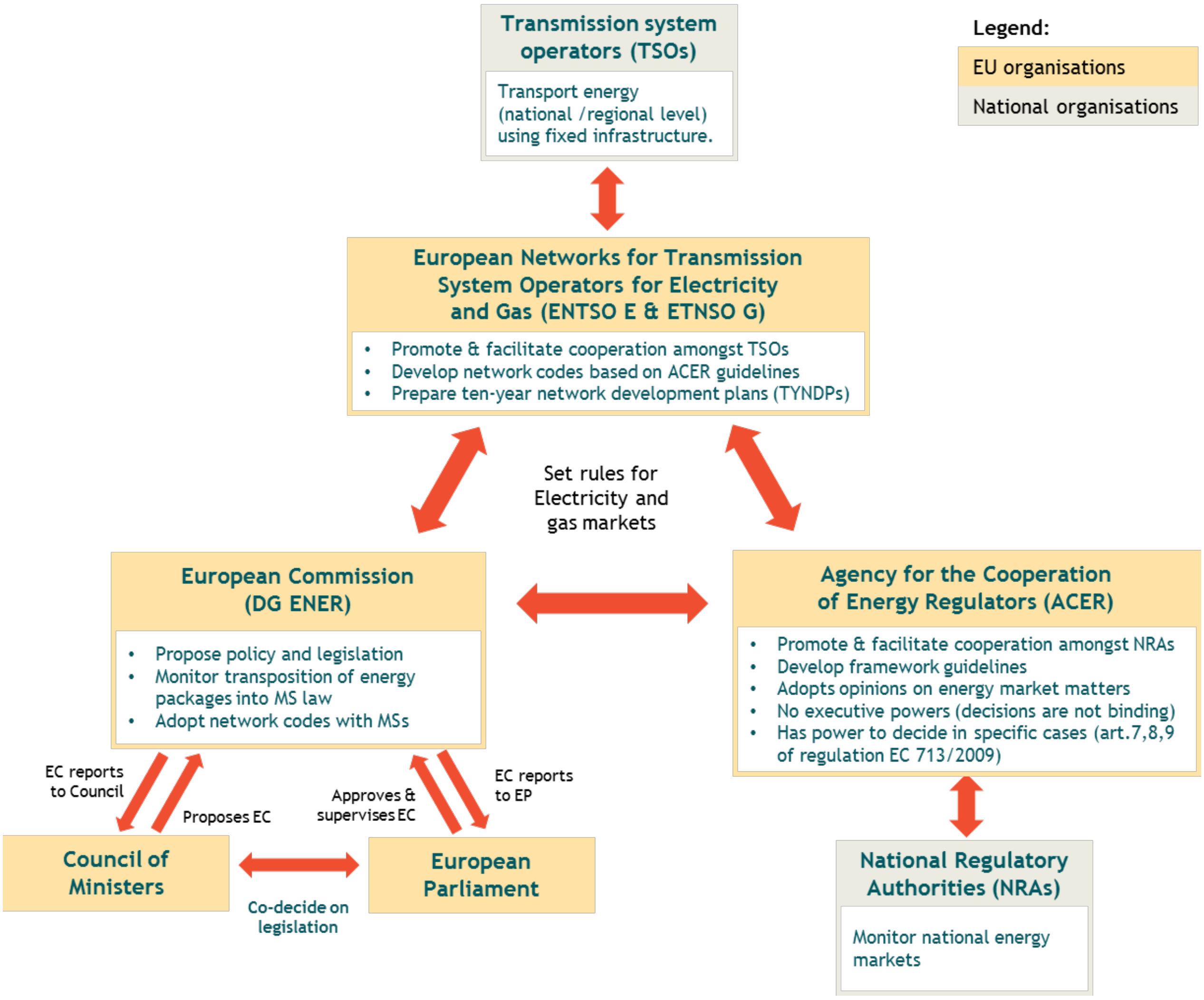
[25] EC (2015c) - COM(2015) 340
[26] Regulation (EU) No 347/2013 Regulation on Guidelines for Trans-European Energy Infrastructure
[27] EC (2014c) - COM(2014) 330
[28] EURELECTRIC (2015c)

renewable energy, and reduce competition distortion, including in areas of policy that are of national competence and should also facilitate coordination and provide more transparency on taxes, charges and levies to help Member States understand their consequences, particularly on cross-border trade.[29] Harmonised and more consistent policies would allow to realise economies of scale and to better value competitive advantages; they also would offer a level playing field which is necessary to avoid competition and market distortions. Finally, the European Commission should ensure that national anti-trust policies and State aid provisions are in line with the EU internal market and competition rules.

3.2. Governance

The figure below provides an overview of the key actors – both at national and EU level - along with their roles and responsibilities.

Figure 3: Key actors on the energy market and their main responsibilities



Source: Diagram developed by Trinomics based on European Court of Auditors (2015).

The following sections present the key EU-level actors:

- The European Commission (EC)
- The Agency for the Cooperation of Energy Regulators (ACER)

[29] EURELECTRIC (2015c) & EURELECTRIC (2015a)

- The European Network of Transmission System Operators for Electricity (ENTSO-E)
- The European Network of Transmission System Operators for Electricity and Gas (ENTSO-G)

3.2.1. European Commission

The European Commission (EC) in general, and DG Energy specifically, plays a key role in the governance structure relevant for the realisation of the Internal Energy Market. The EC proposes new policy and legislation and monitors the transposition of Energy Packages into Member State law.

With respect to the Energy Union governance system, the Commission plays a vital role by:[30]

- Preparing an inventory of planning and reporting obligations and streamlining proposals;
- Preparing draft templates for the National Energy and Climate Plans and Progress Reports;
- Providing guidance on regional cooperation;
- Preparing a methodology for common key performance indicators, (reference) scenarios and projections;
- Preparing a general outlook for an inter-institutional iterative dialogue, dialogue with stakeholders and a detailed calendar for those;
- Collecting the National Energy and Climate Plans from MSs and providing recommendations;
- Collecting the progress reports from MSs every two years and conducting dialogues on progress;
- Monitoring key performance indicators relating to the five dimensions of the Energy Union;
- Delivering annual reports on the State of the Energy Union.

3.2.2. Agency for the Cooperation of Energy Regulators

In 2010, ACER was established in implementation of the Third Energy Package. In March 2011 it started its activities. ACER is an independent agency that ensures that the integration of the European energy market and the harmonisation of regulatory frameworks are achieved within the framework of the EU's energy policy objectives. It assists national regulatory authorities to perform their regulatory tasks at a European level and coordinates their actions if necessary. The agency was set up to fill the increased regulatory gap as NRAs were still nationally oriented in the process towards an internal energy market.

ACER has an advisory role and makes recommendations to the Commission regarding market regulation and priorities for transmission infrastructure.[31] The Agency is responsible for:

- Promoting cooperation between national regulatory authorities

[30] Council of the European Union (2015)
[31] European Parliament (n.d.)

- Monitoring progress in the implementation of the 10-year network development plans;
- Monitoring the internal markets in electricity and natural gas;
- Sharing of good and best practices – collect views of NRAs;
- Interpretation of guidelines;
- Peer-review of decisions by NRAs;
- Residual decisions on cross-border issues (e.g. cross-border interconnectors, cost allocation for projects of common interest).[32]

Currently, ACER acts primarily through recommendations and opinions. ACER has very limited power to take binding decisions (e.g. only at request of NRAs or if NRAs fail to take decisions within a certain time frame). However, fragmented national regulatory oversight has proved to be inefficient for cross-border issues related to the electricity and gas system (e.g. market coupling). The lack of a strong governance and regulatory framework for cross-border issues is a major bottleneck for the integration of the energy markets. While the principles for cross-border grid investments and trade have been determined at EU level, the governance remains an issue of concern and should be reinforced in order to facilitate and accelerate the integration process. The EC also referred in its recent Communication to the potential benefits for the single market if the power and independence of ACER would be reinforced to carry out regulatory functions at European level.[33] There is in general a clear consensus amongst market parties and stakeholders that ACER should indeed be enabled to more efficiently oversee the development of the internal energy market and deal with cross-border issues.

3.2.3. European Network of Transmission System Operators for Electricity

ENTSO-E was created under the Third Energy Package to facilitate the completion of the internal energy market. ENTSO-E represents 41 electricity system operators that are active in 34 countries across Europe.[34] By EU regulation ENTSO-E has been given mandates to contribute to achieving the EU energy goals, in particular by developing EU network codes and by organising a closer inter TSO coordination and cooperation. The main activities of ENTSO-E are listed below.[35]

Table 4: Work products of ENTSO-E to complete the internal energy market

Work product	Explanation
Ten-year network development plan	Identification of investment needs for the pan-European electricity and gas infrastructure. The package includes a report, regional investment plans, a scenario outlook and adequacy forecast.
Cost-benefit analysis methodology	Common methodology to assess investment projects against socio-economic and environmental criteria.
Adequacy	Publication of summer and winter generation outlooks presenting

32 European Parliament (n.d.)
33 EC (2015a) - COM(2015) 80
34 Also multiple non-EU countries are member of ENTSO-E
35 ENTSO-E (2015)

Work product	Explanation
forecasts	the view of TSOs regarding security of supply at different levels and possibilities for countries to cooperate in critical situations by contributing to generation/demand balance. Publication of long-term system adequacy forecast which analyses the system adequacy of the pan-European power system on the long term.
Network Codes	Development of binding pan-European rules (connection codes, operational codes, market codes).
Transparency information platform	A platform that provides free and equal access to fundamental data and information on electricity generation, transmission and consumption.
Regional TSO cooperation	Regional development plans, common auction offices for allocating cross-border transmission capacity (CAO, CASC). ENTSO-E awareness system (EAS)[36] Regional Security Coordination Initiatives (RSCIs)[37] to improve security of supply and maximise the transmission capacity available to the market[38]
Research, development and innovation	R&D roadmap which is a vision on grid projects to be carried out by TSOs R&D implementation plan providing approaches to meet the requirements of the roadmap R&D monitoring report that assesses the progress of TSO-related R&D work and ENTSO-E's progress against its targets set in the R&D roadmap
Electricity data	Collection of data set and figures on power systems.

Source: ENTSO-E.

Despite the positive results of the inter-TSO cooperation so far, ENTSO-E itself emphasises the need to implement further coordination steps to strike a balance between regional flexibility and a centralised approach (to ensure cross-regional coordination).[39] The coordination should mainly focus on:

- Coordinated Security Analysis
- Short and Medium Term Adequacy Forecasts

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36 EAS is a tool to provide real-time view of the energy flows and state of the network across the whole of Europe.

37 RSCIs are initiatives where TSOs cooperate at a regional level on the following domains: coordinated security analysis, short and medium term system adequacy forecasts, coordinated capacity calculation, outage planning coordination, common grid model delivery. Examples of common initiatives are Coreso, SSC, TSC, SCC, MIBEL and Nordic organisations

38 ENTSO-E (2014b)

39 ENTSO-E (2014b)

- Coordinated Capacity Calculation
- Outage Planning Coordination
- Improved Individual Grid Model / Common Grid Model Delivery

Market parties and other stakeholders are in general also in favour of a closer and more structured inter-TSO cooperation. Such a cooperation could offer significant benefits to the TSOs (facilitates the coordination and alignment of processes and procedures and offers economies of scale), and to market operators (more efficient and consistent procedures, etc). The inter-TSO cooperation should also include the setting up of specific common structures for operational activities at regional level (e.g. capacity calculation and allocation); in this context the setting up of regional TSOs should also be considered as a possible option.

3.2.4. European Network of Transmission System Operators for Gas

ENTSO-G was also created under the Third Energy Package and aims to facilitate and enhance cooperation between national gas TSOs in Europe. Its specific objectives are:[40]

- Promote the completion of the internal market for gas and stimulate cross-border trade
- Ensure the efficient management and coordinated operation of the European gas network
- Facilitate the European network's sound technical evolution

The main activities of ENTSO-G are listed in the table below.[41]

Table 5: Main activities of ENTSO-G

Work product	Explanation
Network Codes	The development of a set of common rules for gas market integration and system operation and development (capacity allocation, network connection and operational security)
Network Development Plan	An overview of European gas infrastructure and future developments including the modelling of future scenarios of the gas network
Supply Outlooks	Annual summer and winter supply outlook analysing the gas market and reviewing projects for gas supply, demand and capacity
Operational Tools	The development of a common set of tools for network operation to ensure transparency and coordination of network operation for both normal and emergency situations.

Source: European Gas Regulation (EC) 715/2009

[40] ENTSO G website
[41] European Gas Regulation (EC) 715/2009

3.2.5. Analysis of the governance structure

Our case-study on the Hungarian gas wholesale market (see Box 2 below and Annex 5) shows that non-compliance of national legislation with the EU regulation is not rapidly addressed by the European Commission. We notice that Member States can implement national legislation that conflicts with EU legislation, and maintain it for a rather long time, before being formally forced to withdraw or amend it. In Hungary, the non-compliant national legislation (gas interconnection capacity allocation methodology) was implemented in 2011, and the European Commission has only launched a formal infringement procedure in February 2015, although several market parties had insisted to intervene, also because of the fact that in Hungary (and several other countries), EU investigations and infringement procedures with a European court decision are the only and ultimate way for enforcing compliance.

Non-compliance of national legislation with EU legislation is in general a frequently occurring and major problem: the Commission has opened 38 infringement proceedings against 19 MSs for non-disposal or partial disposal of the Directives under the Third Energy Package, but these procedures usually take much time before they lead to effective results.[42] Incomplete or incorrect national implementation of EU regulation results in market and competition distortions. Therefore, full compliance of national legislation with EU regulation is essential; if infringements are presumed, the European institutions should rapidly react and, if necessary, launch a formal enquiry in due time. Maintaining non-compliant national legislation over several years should be rendered impossible as it might hamper competition and market integration.

Box 2: Key lessons learned from the case on the Hungarian gas wholesale market

The context and key findings of our case study on the Hungarian gas wholesale market (For details, see Annex 5) are hereafter summarised.

Hungary endorsed in 2011 a Ministerial Decree which ceased the auctioning procedure for gas import capacity from Austria and allocated it exclusively to 2 national companies. This decree was obviously not compliant with the EU regulation. This measure was discriminatory and hurting the rights of other gas trading companies, which ultimately left the Hungarian market. It also resulted in higher gas prices for professional end-users (companies). It is assumed that this political decision has mainly been taken in order to mitigate the risks and negative financial impact of the long term gas contracts with Gazprom on the Hungarian state budget.

Hungary has maintained this non-compliant regulation for about 4 years without a formal penalty or request from the European Commission to withdraw or amend it.

Such infringements of EU legislation should be more rapidly and effectively addressed at EU level. The follow-up of these cases by the EU institutions should be accelerated and intensified, especially if the violation of EU regulation is evident and market parties are formally complaining. In several countries, including Hungary, EU investigations and infringement procedures with court decision are indeed the only and ultimate way for enforcing compliance with EU legislation.

The new Regulation on Energy Market Integrity and Transparency (REMIT) can contribute to avoid market distortions, as wholesale contracts and related prices and volumes should be reported, and the competent regulatory authority will have to collect and analyse

[42] SWD(2014) 315 final

wholesale market data. Based on these data, market abuse can be tracked more easily. However, as REMIT is still in its implementation phase it is too early to evaluate whether this initiative will effectively ensure greater transparency in markets and contribute to reduce the risk of market manipulation.

On the basis of the evaluation of the development of the wholesale gas market in Hungary, we can also conclude that both physical and virtual gas hubs are important instruments for developing liquid and competitive gas markets. There are currently many gas hubs in Europe, but only few in the Eastern part of the EU. If a gas hub is established and operated in a proper way, it is the most effective way to have transparent trade, in particular in countries where the gas consumption is significantly lower than in some western countries. Setting up a gas hub or trading point where the Russian gas import reaches the CEE region would be favourable.

In several regional or EU-level projects (e.g. market coupling projects, see our case study in Annex 3) national authorities, TSOs, regulators and energy exchanges of different Member States need to cooperate. However, as they are primarily responsible for their own national gas and electricity system and market they are not always sufficiently motivated to also take supranational interests into account. Moreover, national regulators, TSOs and PXs are cooperating with each other on a voluntary basis, without clear hierarchy or external arbitrage. For these reasons, the process to agree on a common solution is often slow, difficult and intricate, given the individual and national (sometimes conflicting) interests. This leads to complex and slow decisional and implementation processes for most cross-border projects, resulting in delayed implementations (e.g. the intra-day markets' coupling project). A stronger regulatory oversight and governance structure at supranational/EU level (in particular ACER) is needed to steer and accelerate these processes.

On the basis of our analysis of the market coupling projects (see our case-study in Annex 3), we conclude that a regional approach has been and will remain decisive for the integration of the European energy market. Cooperation within a smaller group than the entire EU can go faster and can be better suited to address the particular challenges of the region concerned. This approach necessitates good interaction and coordination between top-down initiatives (such as legislation, guidelines, network codes, target market models, etc.) and bottom-up approaches (implementation projects at regional level), which should be consistent with each other to facilitate the transition to a fully integrated market. The case-study also confirms the need for a reinforced role for ACER to facilitate and accelerate this process. Moreover, stronger and more structured inter-NRA and inter-TSO cooperation as well as further integration of energy exchanges and TSOs would also contribute to a more rapid and efficient market integration.

In this context the setting up of regional TSOs that should deal with all cross-border issues, should be considered. A study conducted by DNV GL, Ecorys and ECN on behalf of the EC[43] proposes a target model in order to improve system operation and planning functions of TSOs. The study recommends the centralisation of long-term network planning functions and system operation functions before real-time (e.g. capacity calculation, congestion management, adequacy assessments and balancing) by installing regional operational centres (ROCs) in Europe by 2020. This will imply that these functions (including decision powers) will no longer be executed by national TSOs but on a regional level. Until these ROCs have been installed, the EC proposes a regional division that integrates Capacity

[43] Slot, T. and Dijk, H. (2015)

Calculation Regions into larger areas. The creation of regional TSOs with appropriate legal mandate would optimise the adoption of regional agreements between national entities[44].

Increased cooperation between ACER and the ENTSOs could also be beneficial as regulatory questions are often of a cross-border nature. For ACER and the ENTSOs to function effectively, the active participation of its national members is essential.

ACER also emphasises the need for 'improved coordination' between TSOs and DSOs and 'more clearly defining their respective roles and responsibilities'.[45] This would indeed be beneficial, as congestion management, balancing and demand response have also become relevant issues at distribution level. ACER also proposes that gas and electricity TSOs should be legally obliged to cooperate with each other in order to ensure more efficient use of gas-fired power plants to provide balancing services and flexible back up capacity to RES.[46] This proposal merits further assessment: the gas transmission tariff structure (e.g. capacity based versus volume based grid fees) has for instance a major impact on the cost and positioning of gas fired power plants in the merit order and on the availability and cost of balancing reserve capacity. Closer cooperation between gas and electricity TSOs would facilitate careful assessment of these impacts, in order to propose solutions that are optimal from a macro-economic or environmental perspective.

[44] Juan José Alba Ríos (Chairman, EURELECTRIC Markets Committee Vice President Regulatory Affairs, ENDESA) suggested this issue in a meeting held on January 22th at Endesa premises in Madrid.
[45] ACER (2014a)
[46] ACER (2015b)

4. ELECTRICITY AND GAS MARKETS

KEY FINDINGS

The ongoing integration process of the wholesale electricity and gas markets is successful to a certain extent and offers large macro-economic benefits:

- increased price convergence
- enhanced competition
- lower overall energy system costs and increased security of supply

Market integration is however hindered by:

- slow and complex decision-making and implementation processes,
- diverging national policies and market rules, by insufficient interconnection capacity and
- in some cases, by inadequate capacity allocation procedures.

Furthermore, the strong development of intermittent RES leads to more grid congestion and decreasing electricity price convergence. In some MSs, retail markets have become very competitive with high switching rates, but in others consumers cannot yet fully benefit from competitive markets.

Key challenges to improve the functioning and integration of the electricity and gas markets are:

- To better harmonise national energy market related legislation and rules.
- To ensure the timely and correct implementation at national level of EU legislation and network codes.
- To facilitate and accelerate the implementation of the target market models by an efficient governance structure.
- To create large (supranational) and liquid short term electricity markets, also in order to efficiently cope with the increasing share of variable RES.
- To increase the interconnection capacity where necessary and to optimise the capacity calculation and allocation processes in order to maximise the overall social welfare.
- To open up all retail markets for competition and to allow and stimulate market operators to develop energy services and to apply wholesale market-based pricing formulas.

4.1. Wholesale electricity market

4.1.1. Description of the wholesale electricity market

In the wholesale electricity market generators or traders sell electricity to traders, suppliers or large end-consumers. In the wholesale market electricity can be traded in various ways:

- **At a power exchange or multilateral trading platform:** market participants submit their offers and bids and when the market is cleared a single market price is determined on the basis of the marginal bid.
- **Bilateral over-the-counter (OTC) trading:** a producer and a trader/supplier/consumer agree bilaterally on a trade or supply contract.

- **Organised over-the-counter trading:** market participants submit bids and offers to a platform. Market players can bilaterally accept bids of other players, which results in a different price for each transaction.

Electricity is traded in different sequential markets varying from markets starting up to several years before the actual delivery of electricity to markets ending at the actual delivery. In an electricity system demand and supply of electricity must be in balance at any time.[47] The figure below provides an overview of the different electricity markets in Europe.

Figure 4: Overview of different electricity markets in Europe.

Source: Adapted from KU Leuven, 2015b.

a. Forward and future market

In the forward and future market electricity is traded 1 or several years in advance. In a future or forward contract parties agree on a price for the sale of electricity in the future (e.g. year x+1 or x+2). Futures are standardised contracts which can be traded further on power exchanges, whereas forwards are mostly bilateral contracts that are usually not traded further. The future and forward markets allow market parties to hedge their price risks. Forwards and futures can be traded within and between market zones.[48]

b. Day-ahead market

In the day-ahead (DA) market electricity is traded bilaterally and at the power exchange. At the time of closure of the day-ahead market each market zone needs to be in balance meaning that scheduled generation needs to equal forecasted demand plus (or minus) net export to (or import from) other market zones. In the day-ahead market, market zones can be coupled with each other; day-ahead market coupling is explained in more depth in our case study in Annex 3.

c. Intra-day market

In the intra-day market electricity is traded on the day of delivery and allows market participants (balance responsible parties) to correct for deviations from their day-ahead nominations (e.g. due to unexpected wind or solar conditions, changes at the demand side or unplanned power plant outages). After clearing the intra-day market, the nominations of

[47] In case the system is not in balance, the grid frequency will deviate from the reference value which may result in a system collapse.

[48] In case of trade between two market zones, cross-border transmission capacity is allocated explicitly before trading electricity

market participants can be imbalanced (in contrast to the closure of the DA-market when a balanced portfolio is needed).

d. Balancing market

Balancing markets allow TSOs to deal with the real time imbalances between the actual injections and offtakes of electricity in the grid. These markets can be split into the balancing reserve procurement and the settlement side:

Procurement and activation of reserves

In the reserve market TSOs contract different types of reserves:

- Frequency containment reserves (‘primary reserves’) are used to stabilise the grid frequency within seconds by activating automatically controlled reserve capacity which is activated locally.
- Frequency restoration reserves (‘secondary reserves’) restore the system balance. Their activation time ranges from seconds up to 15 minutes. They are controlled automatically and activated centrally.
- Replacement reserves (‘tertiary reserves’) are used in case frequency restoration reserves are not sufficient to restore system balance. They must be active between minutes to hours and are controlled manually and activated locally.

Settlement of imbalances

A tariff is imposed to each balance responsible party[49] that is in imbalance in real time. The imbalance tariff is in general based on the actual average (or marginal) procurement cost of the TSO for balancing energy, and includes sometimes a specific penalty or bonus in order to incentivise balancing responsible parties to keep their portfolio in balance. The settlement of the imbalance takes place after delivery.

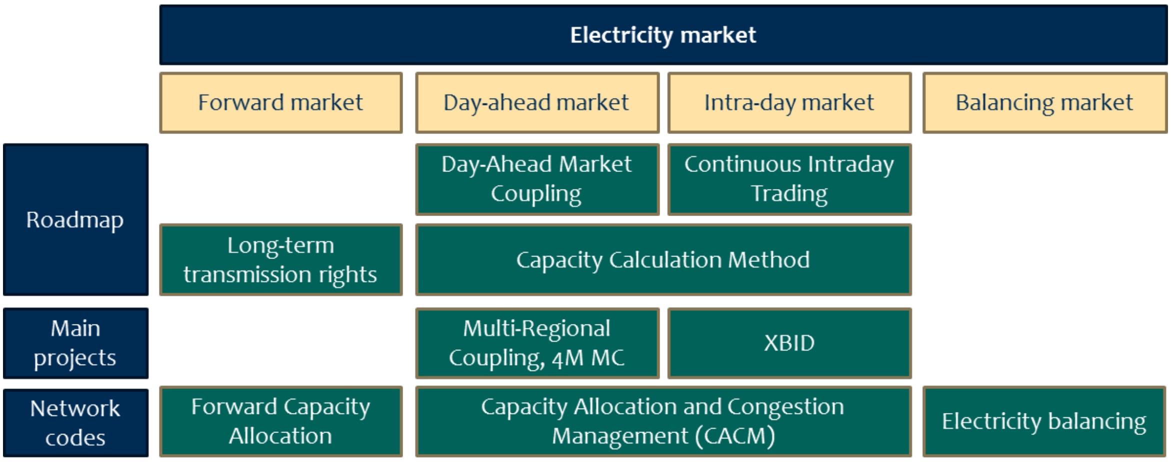
4.1.2. Analysis on the progress towards electricity target model and IEM

The progress towards realising the Internal Energy Market in general and the electricity target model specifically is stimulated by various initiatives. Key initiatives in this context and their relation to the different electricity markets (i.e. forward, DA, ID, balancing) are summarised in the figure below and will be described in more detail in the next paragraphs.[50]

[49] A balance responsible party has the obligation to balance its portfolio before the market closure, which means that his planned injection into the grid (generation, storage or import) must be for each hour in balance with his offtake from the grid (consumption, supply or export).

[50] Ofgem (2012)

Figure 5: Overview of roadmaps, projects and network codes per market



Source: Author.

Network codes have already been discussed in section 3.1. Regional initiatives for cooperation (roadmaps), focusing on 4 projects, are summarised in Table 6.

Table 6: Cross-regional roadmaps.

	Cross-regional Roadmap	Leader of roadmap	Aim
Electricity Regional Initiative (ERI)	**Day-Ahead Market Coupling**	BnetzA (Germany), AEEG (Italy)	To deliver a single European price coupling model, thereby optimising the use of cross-border generation and interconnection capacities, reducing prices volatility and divergence and improving confidence in organised price references
	Continuous Intraday Trading	Ofgem (UK)	To implement a single European continuous implicit allocation and trading mechanism for cross-border intraday trade.
	Capacity Calculation Method	CREG (Belgium), E-Control (Austria)	To implement a Flow-Based Calculation Method for short-term capacity allocation to improve network security and the level of capacity made available to the market
	Long-Term Transmission Rights	CRE (France), EI (Sweden)	To establish common European Long-Term Transmission Rights and a single point of contact by: • Harmonisation of allocation rules • Establishment of single allocation platform • Harmonisation of nomination procedures • A potential move to Financial Transmission Rights (FTR)[51]

Source: ACER (2014) ACER Coordination Group for Electricity Regional Initiatives ERI Progress Report #3.

[51] ACER (2014b)

a. Calculation and allocation of interconnection capacity

An appropriate capacity calculation and allocation mechanism is important to facilitate market coupling and hence the integration of electricity markets. To allow market participants to hedge their risks related to congestion costs and prices, one single access point for electricity and a harmonised set of rules for medium and long-term transmission rights is created.[52] To do this, four measures were identified by ACER:

- harmonisation of allocation rules (HAR);
- implementation of a single allocation platform;
- harmonisation of nomination procedures;
- a potential move to Financial Transmission Rights.

A single set of harmonised auction rules[53] regarding the allocation of transmission rights has been approved by all TSOs on 30 June 2015.[54] The HAR is applicable since 1 January 2016 on borders that were approved by NRAs for long-term transmission rights.[55] The merger of two regional allocation platforms (CASC.EU and CAO) resulted in a new entity (Joint Allocation Office, JAO[56]) that is expected to run the auctions for the 2016 annual transmission rights on 27 borders in Europe and to act as a fall-back for the European Market Coupling.

b. Day-ahead electricity wholesale market coupling

Our case study on market coupling in the CWE and CEE region (see Annex 3) provides relevant insight on the benefits of market coupling and the key challenges. Market coupling refers to the integration of two or more electricity markets from different countries. The mechanism aims to optimise the free trade of electricity between the concerned markets in order to maximise the overall social welfare.[57] It allows buyers and sellers on a power exchange to benefit automatically from available interconnection capacity, without having to conclude a separate contract for the corresponding capacity, hence the term 'implicit auction'. There are a number of economic benefits emerging from market coupling, including:

- Enhanced competition at supranational level;
- Improved competitiveness and more converging prices;
- Improved security of supply; and
- Support to RES development.

Day-ahead market coupling implies the coupling of day-ahead bids and offers of different power exchanges and applying a single algorithm to determine cross-border flows and day-ahead electricity prices. As all bids and offers of the concerned markets are combined, the electricity generating installations with the lowest variable cost will be used to cover

[52] ACER (2015a)
[53] Developed under the cross-regional road map on Long Term Transmission Rights
[54] ENTSO-E has published a consolidated version of the main body of the HAR and its annexes for information purposes only. The final document is subject to the outcome of the regulatory process applicable in each relevant jurisdiction
[55] ENTSO-E (n.d.)
[56] The JAO is a joint service company of 20 Transmission System Operators (TSOs) from 17 countries
[57] There is no ex-post analysis of the impact of this implementation. Nevertheless, based on simulations published by ACER (2012) and EP (2013), the CWE region alone has achieved gains from trade worth more than 250 million Euros per year in comparison to isolated national markets. Further details can be found in annex 3 – Case study on day-ahead market coupling in CWE and CEE.

demand and electricity prices will be harmonised, until congestion takes place.[58] This means that there will be full price convergence in the coupled region when there is sufficient cross-border capacity available, while a price difference between countries will still occur when there is congestion at the interconnection.

The purpose of market coupling is to maximise the overall economic welfare at supranational level. Well integrated markets make capacity and energy available between countries, connecting their energy mixes. This contributes primarily to three main objectives: higher security of supply, lower overall price level and higher efficiency of the energy system.

Market coupling requires:

- 'Spare' generation capacity available for the day ahead in at least 1 country
- Adequate transmission networks and available cross-border interconnection capacity
- Liberalised national wholesale markets

Between 2006 and 2015 the day-ahead markets of 19 European countries were coupled. February 2014 marked the date of the first implementation of the Price Coupling of Regions (PCR) solution in North Western Europe (NWE). Completion of this project is a major step towards an integrated European power market. It was the first regional market initiative to use the pan-European PCR solution for the calculation of prices and flows - the starting point for all other regions to join. The project incorporates the previously coupled Central West European region (CWE) with the Nordic, Baltic and UK power markets, along with the SwePol link between Sweden and Poland. In May 2015, Flow-Based Market Coupling (FBMC) was introduced in the CWE region, replacing the Available Transfer Capacity (ATC) method which was in place since end of 2010. The next step is joining other regions, including Central-Eastern Europe (CEE) to the NWE region, which is expected to happen in 2015/2016.

The implementation of electricity market coupling has initially led to a substantial increase in price convergence, but this positive evolution stopped in 2013. In the CWE region, the number of hours with price convergence between Germany, the Netherlands, France and Belgium dropped from 68 % in 2011 to only 5 % in the first 8 months of 2015. The number of hours with price convergence between Slovakia, Czech Republic, and Hungary (CEE region) increased from 11 % to 82 % after effective market coupling in 2012, but declined by 8 % in 2013 and further deteriorated in 2014-2015. Price convergence is indeed since 2013 negatively impacted by shifts in the power generating mix (e.g. nuclear phase out) and the strong development of wind and solar energy in some MSs, which has resulted in large export volumes of electricity to neighbouring countries, resulting in more congestion at the borders and less price convergence.

The observed price divergence following increased levels of RES deployment demonstrates untapped market integration potential which is likely to grow as more RES will be added to the European energy mix. The key to unlocking this potential is to increase the interconnection capacity, if a cost-benefit analysis effectively confirms that additional grid investments offer social welfare. In order to identify possible needs for increased interconnection capacity it is recommended to include price divergence levels as one of the guiding indicators for a preliminary assessment. Additional interconnection capacity is of course not the only solution to be considered in order to avoid or reduce structural congestion; other instruments (flexible supply, storage, demand response) should be assessed on an equal basis.

[58] Amprion, APX, Belpex, Creos, Elia, EPEXpot, RTE, Tennet, Transnet BW (2014)

Box 3: Key challenges and recommendations from the case on market coupling

On the basis of our case studies regarding the day-ahead wholesale market coupling in Central Western Europe (CWE) and Central Eastern Europe (CEE) (see detailed information in Annex 3), we have identified the following key challenges and recommendations for market coupling:

- The consumer and producer surpluses of market coupling are not equally spread amongst MSs and market parties. Market coupling should maximise the social welfare at supranational level, and should not be hindered by negative impacts on individual operators or MS.
- Interconnection capacity should be extended where macro-economically justified (in particular in case of structural congestion) and its availability for commercial purposes should be maximised.
- Preliminary conditions should be met for effective market coupling and price convergence:
  - The MSs have to be committed to ensuring the development of liberalised and competitive markets;
  - The trading mechanisms used in Member States have to be compatible across borders. If one Member State uses a business to business model and the other is part of a regional exchange, effective market coupling is impossible; and
  - Sufficient capacity of the transmission networks across borders, but also within Member States, has to be (made) available.
- The need for a balanced governance approach, including additional governance at EU level (a reinforced role for ACER) as well as stronger and more structured inter TSO cooperation.
- As energy exchanges play a vital role in the integration processes of energy markets in Europe, more regulation of power and gas exchanges seems appropriate.
- The need for more transparency and technical coordination for proper design and implementation. An appropriate methodology for calculation and allocation of cross-border transmission capacities is key to maximise the benefits of market coupling.
- The need for more harmonised national energy policies and market rules.
- The need to also integrate the intra-day and balancing markets at supranational level. Cross-border procurement of ancillary services (reserve capacity) should also be stimulated.

c. Intra-day electricity wholesale market coupling

Intra-day markets enable market participants to adjust their nominations between the closure of the day-ahead market and real-time operation in order to limit the imbalance risk. The increasing share of intermittent generation has increased the importance of the intra-day market. Therefore, the European Commission has developed a Target Model for Intraday in which cross-zonal transmission capacity is allocated through implicit continuous allocation.[59] Benefits of an integrated intraday market include efficient competition and

[59] This model has been laid down in the Framework Guidelines for Capacity Allocation and Congestion Management

pricing, increased liquidity and more efficient utilisation of resources (generation, storage, demand response). Furthermore, an integrated intraday market will reduce the need for reserves to balance the system and its associated costs.[60]

Several cross-border intraday solutions exist across Europe. On some borders, explicit capacity allocation takes place, whereas on other borders implicit capacity allocation is applied. The most important initiative, called Cross-border Intraday (XBID) Market Project, was launched in 2013 by power exchanges and TSOs from 12 countries (CWE/NWE + Austria and Switzerland). An EU-wide application of this approach would create an integrated European Intraday Market in line with the target model. This solution is based on a common IT system in which offers and bids submitted by market participants from different countries are shared (Shared Order Books). Also, intraday cross-border capacities are made available by the TSOs in the Capacity Management Module. Orders submitted from different market areas can be matched in case sufficient interconnection capacity is available (implicit capacity allocation). If an explicit capacity allocation method (auction) is used at the border, the residual capacity can also be made available. In order to implement the XBID solution, local implementation projects (LIPs) have been set up. These LIPs are projects that involve one or more borders and aim to adapt local arrangements (e.g. through procedures, contracts, etc.) at the equal treatment between PXs in order to ensure the participation in the XBID test period. The implementation of the XBID project was supposed to take place by the end of 2014. However, the implementation was delayed mainly due to technical issues and difficulties in reaching consensus among the project partners.[61] These delays and difficulties are mainly due to the lack of a competent supranational regulatory body than can intervene and decide if the positions of the concerned partners are not converging.

d. Integration of electricity balancing markets

At the moment, different national market designs and operation principles still exist for the balancing market.[62] The procurement and settlement rules of balancing services differ widely, not only in organisation, but also in sizing, product definitions and remuneration schemes. Cross-border procurement and exchanges of balancing reserves and energy are therefore still very limited.

Large gains could be realised by harmonising and integrating the balancing markets at EU level. To this end, ACER has adopted Framework Guidelines on Electricity Balancing in 2012 with the aim to increase cross-border competition in the balancing market.[63] The models for cross-border exchanges of balancing energy are central in the Framework Guidelines and should first emerge in some geographical areas and gradually[64] be integrated into one single European platform where all TSOs have access to different types of balancing energy while taking into account available transmission capacities between different areas. To enable the creation of such a market, several requirements need to be met, such as a common set of rights and obligations for all types of market participants (generation, storage and demand response). On the basis of these Guidelines, a new EU wide network code on electricity balancing has recently been developed; it will contribute to align to a certain degree the balancing products and rules, and will indeed facilitate cross-border exchanges.

[60] EPEX SPOT (n.d.)
[61] ACER/CEER (2015)
[62] EURELECTRIC (2015a)
[63] ACER (2015d)
[64] i.e. within 6 years after the entry into force of the Network Code on Electricity Balancing,

With the increasing development of intermittent power generation (solar and wind energy) and the expected evolutions at the demand side (demand response, electric vehicles), the role of balancing services is expected to grow, in particular to manage short-term fluctuations in demand and supply and to ensure system reliability. This increasing need for balancing services can be more efficiently addressed via harmonised and integrated balancing markets. In this context, several initiatives have been taken at regional level (mainly in Northern and Western Europe) but the European momentum slowly gathers pace.

Therefore, the key challenge at EU level in the domain of balancing services is to define a target model and to put in place an adequate regulatory framework which enables and stimulates cross-border exchange of balancing energy and supra-national (regional) procurement of balancing reserve capacity. Balancing market integration will indeed offer substantial macro-economic benefits:

- Enhanced and fairer competition amongst Balancing Services Providers
- Level playing field for Balancing Responsible parties that are active in different balancing zones
- Larger and more liquid markets offer higher transparency in price formation and more representative price signals
- Lower overall cost and lower environmental impact of the energy system
- Facilitated integration of intermittent RES
- Enhanced security of supply

4.2. Wholesale Gas Market

4.2.1. Objectives of a wholesale gas market

In the wholesale gas market, participants (e.g. producers, suppliers, large end-users, brokers and traders) buy and sell natural gas for delivery in the short term (intra-day, day ahead, spot contracts) or in the near future (monthly, quarterly, seasonal or yearly future or forward contracts).

Wholesale gas markets must contribute to a ready availability of gas to cover demand at any time, competitive gas price formation, low transaction costs of gas trading and transparent gas prices.

Well-functioning wholesale gas markets offer benefits to both market parties and end-users:

- Competitive prices lead to lower costs for end-users
- Liquid markets with low transaction costs allow market parties to hedge their price and volume risks at low cost
- Transparent price formation benefits both end-users and market parties.

It is clear that a large supranational and liquid wholesale gas market offers higher benefits to market parties and end-users than isolated national markets, in terms of competitive and transparent price formation, among others. The interconnection of the gas supply system and the integration of the gas markets across Europe are hence an important priority in the energy policy. Regulation EC 715/2009 (gas transmission) aims for instance at facilitating the emergence of a well-functioning and transparent wholesale gas market.

4.2.2. Analysis on the progress towards gas target model and IEM

In January 2015 a review and update of the Gas Target Model (GTM) was published in which issues were identified that justify the need to further develop the vision of the Gas Target Model.[65] ACER stated that well-functioning European gas markets are the exception rather than the rule in 2014, despite the fact that the IEM should have been completed in that year. According to ACER the European gas market and its associated challenges and uncertainties have changed significantly since the formulation of the GTM in 2011, and a revision is therefore necessary. Supply and demand of natural gas have for instance become more uncertain in recent years as a result of various reasons: the impact of energy efficiency policies, the development of renewable energies (including biogas), the 'revival' of coal due to the low market price for carbon dioxide (CO2) emission allowances and the decline of the gas production in Europe (mostly in the Netherlands and UK). Well-interconnected gas systems and markets enhance security of supply as in this way consumers will not depend on one source of supply that can be limited due to physical or political reasons. ACER stresses that the measures to ensure an internal gas market should be market-based, such as dynamic imbalance prices (with no price caps) in case of emergency.

A well-functioning and transparent wholesale market is an important goal of the Gas Target Model and includes both a liquid spot and forward market. However, forward trading in gas is still highly limited in the EU and should be facilitated. The updated GTM includes an assessment of the functioning of the wholesale market at national level by developing a series of metrics to assess the 'well-functioning' of the market.[66] The metrics on which the analysis is based are whether the market can meet its participants' needs[67] and whether the market is 'healthy'[68]. In case a MS does not meet these metrics the GTM suggests market reforms (such as full market mergers, trading regions or satellite markets).

The figure below provides an assessment of the achievement of the targets that were set for the Gas Target Model in 2011.[69] It shows that only the United Kingdom meets all criteria while most Central-Western countries and Spain are close to meeting them. The Eastern European gas markets are still far away from meeting these criteria.

Such an analysis at MS level based on national figures should be interpreted with caution as most national systems and markets are meanwhile interconnected; in this context a market with a high HHI level at national level can anyhow be competitive if several sources and sufficient interconnection capacity are available.

65 ACER (2015b)

66 ACER (2015b)

67 A market is considered to meet its participants' needs if it can facilitate effective risk management by offering a variety of adequate products and a high liquidity to the market participants. The metrics include order book volumes, bid-offer spread, order book price sensitivity and number of trades for day-ahead products, front month products and forward products.

68 A market is considered as « healthy », if it can demonstrate it is competitive, resilient and able to ensure security of supply. The metrics include the Herfindahl-Hirschmann Index, the number of supply sources, the residual supply index, the market concentration for bid and offer activities and the market concentration for trading activities

69 ACER (2015b). This assessment is based on the metrics that were in place before the update of the GTM. Churn rate (= total volume of gas traded compared to the volume of gas consumed) and zone size have been removed in the updated GTM.

Table 7: Overall results of the GTM 2011 criteria assessment[70]

Member State	Number of sources	HHI	RSI
Austria	3	7,500	143 %
Belgium	8	1,709	279 %
Bulgaria	2	7,587	13 %
Croatia	5	5,987	125 %
Czech Republic	3	9,051	159 %
Denmark	2	2,570	22 %
Estonia	1	10,000	0 %
Finland	1	10,000	0 %
France	13	1,240	137 %
Germany	4	1,982	116 %
Greece	9	5,181	131 %
Hungary	4	3,198	60 %
Ireland	2	1,215	8 %
Italy	12	2,093	108 %
Latvia	1	10,000	0 %
Lithuania	1	10,000	0 %
Luxembourg	4	3,185	0 %
The Netherlands	6	2,488	189 %
Poland	3	4,550	56 %
Portugal	6	2,821	93 %

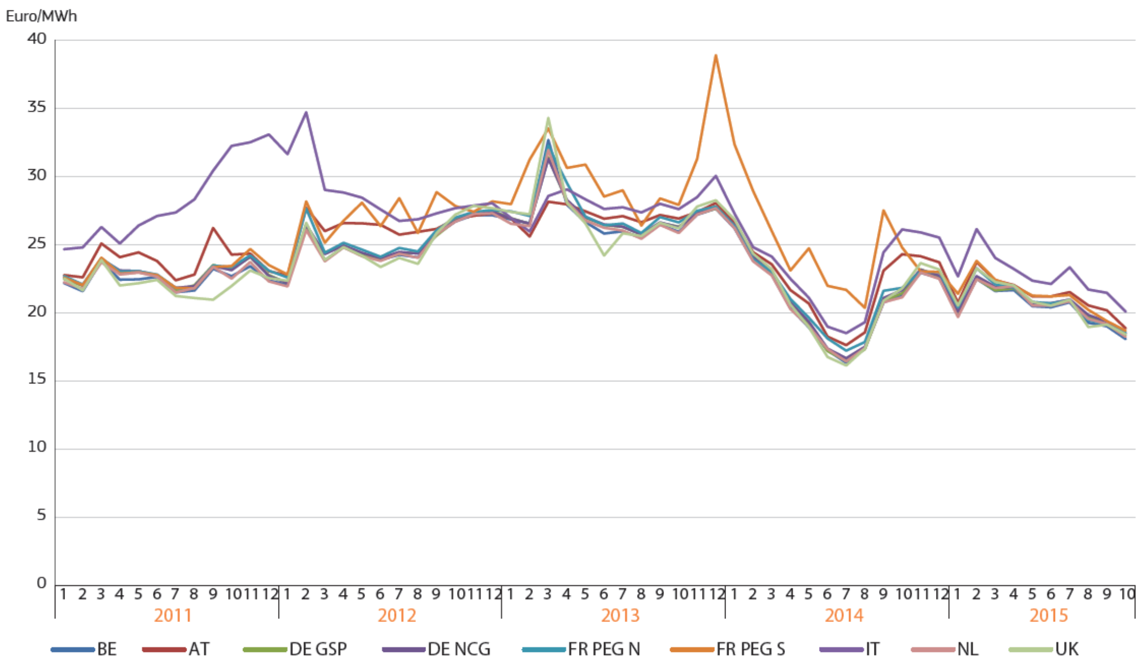
[70] HHI is the sum of squared market shares of wholesale gas supply companies measured in % of total wholesale gas supply. RSI = (total supply – largest seller's supply) / total demand.

Member State	Number of sources	HHI	RSI
Romania	4	3,270	104 %
Slovakia	2	9,595	369 %
Slovenia	5	5,027	74 %
Spain	12	2,000	159 %
Sweden	1	2,766	0 %
United Kingdom	11	950	142 %
GTM target	**≥3**	**<2,000**	**≥110 %**

Source: Frontier Economics, published in ACER (2015b)

In the figure below an overview of the development of European wholesale gas prices is given. Increased convergence of gas prices can be observed, but some differences in prices remain for instance caused by infrastructure bottlenecks, a difference in gas quality or inappropriate market policy/rules.[71]

Figure 6: Development of wholesale gas prices on gas hubs in the EU.



Source: EC (2015i)

In some MSs, interconnection capacity was not allocated according to the gas target model resulting in market and competition distortion. Our case study on the Hungarian wholesale gas market (see Box 2 and Annex 5) shows indeed that in Hungary the interconnection capacity at one entry point was not allocated according to market based rules, but was

[71] EC (2015e) -SWD(2015) 243 final

granted exclusively to two gas companies, which hindered the access to (cheaper) Western gas resources for other gas traders/suppliers and forced them to leave the market.

4.3. Retail markets for gas and electricity

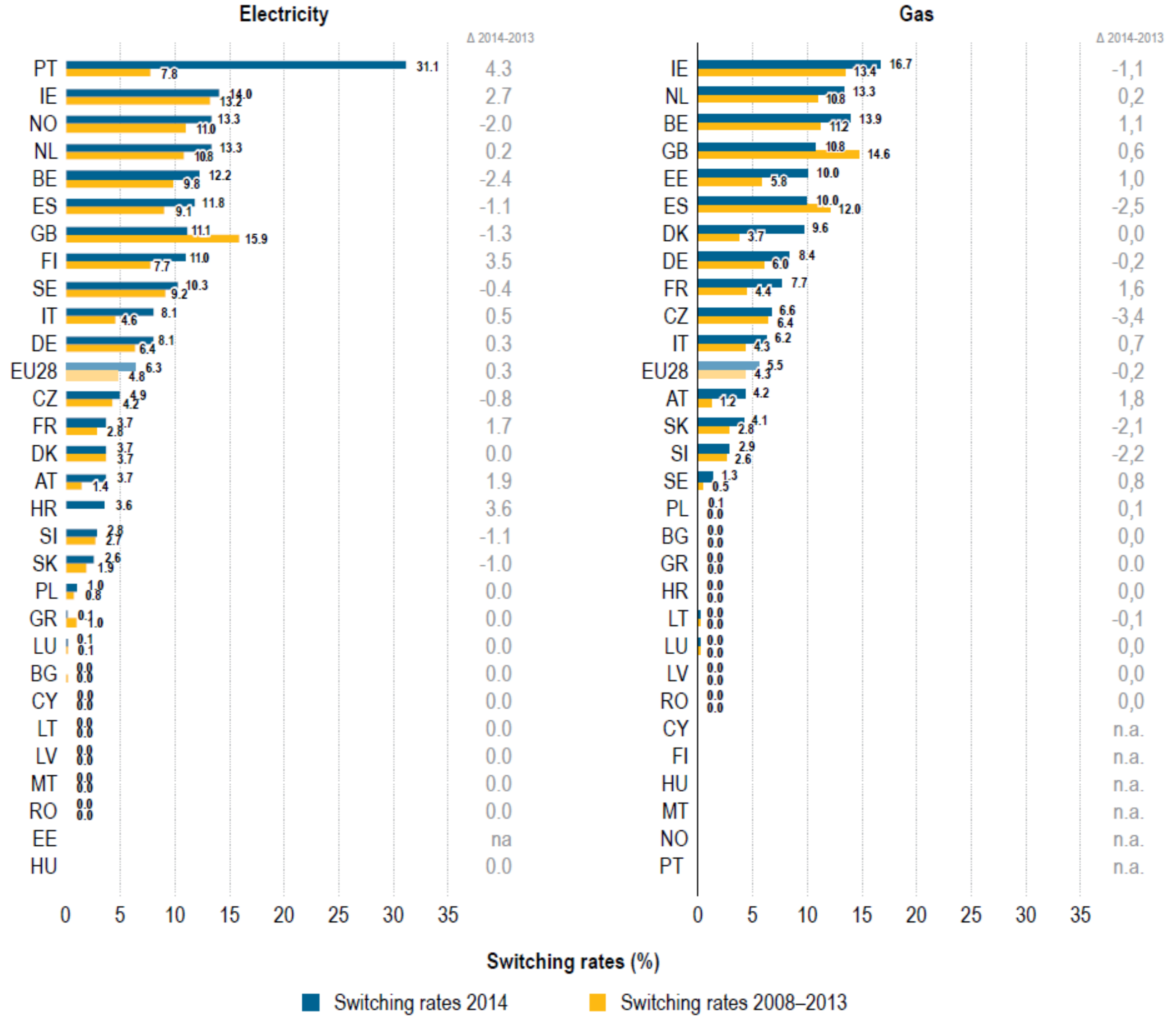
Despite the fact that most EU wholesale markets are interconnected and to a large extent organised and integrated at a supranational level, in most European countries retail markets for both electricity and gas are still organised at a national (or subnational) level. The integration of retail markets is considered less of a priority compared to the integration of wholesale markets. Cross-border integration of retail market can however provide benefits such as economies of scale and enhanced competition. Possibilities for harmonisation on retail level (e.g. roles and responsibilities of TSOs, DSOs, suppliers; requirements for data availability and exchanges) could be assessed on the basis of European regions where retail market integration is considered (e.g. Common Nordic End-User Market)

Moreover, in many countries consumers still do not play an active role in the retail market, such as by changing their supplier or by demand response. Figure 7 shows that in many European countries the switching rate is near to zero or very low, while other retail markets are very dynamic and competitive (switching rates > 10 %). According to ACER, European consumers are inactive in the retail market as a result of insufficient monetary gain, lack of trust in a new supplier and the perceived complexity of the switching process (e.g. administrative burden) and the fact that many consumers are satisfied with their current supplier.[72] As in several retail markets consumers do not actively change their supplier, the competitive pressure on suppliers is low and these markets remain highly concentrated. Other reasons for a lack of competition in retail markets are regulatory interventions (e.g. regulated prices, energy taxes/surcharges and grid fees), or a lack of appropriate information on costs and consumption and/or transparency in offers.[73]

[72] ACER (2015)
[73] EC (2015c) - COM(2015) 340

Figure 7: Switching rates for electricity and gas household consumers

Values in 2014, annual average 2008-2013 and change 2014-2013 (%)



Source: ACER/CEER (2015)

As can be seen from Figure 8 the switching rates of consumers in countries with regulated retail prices are almost 2-3 times lower than in countries without regulated retail prices.[74] Despite the fact that several countries have ended price regulation, regulated retail prices are still widespread across the EU.[75] Regulated electricity and gas retail prices exist in 14 countries for households, whereas for industry regulated prices still exist in 9 countries for electricity and in 10 countries for gas.[76]

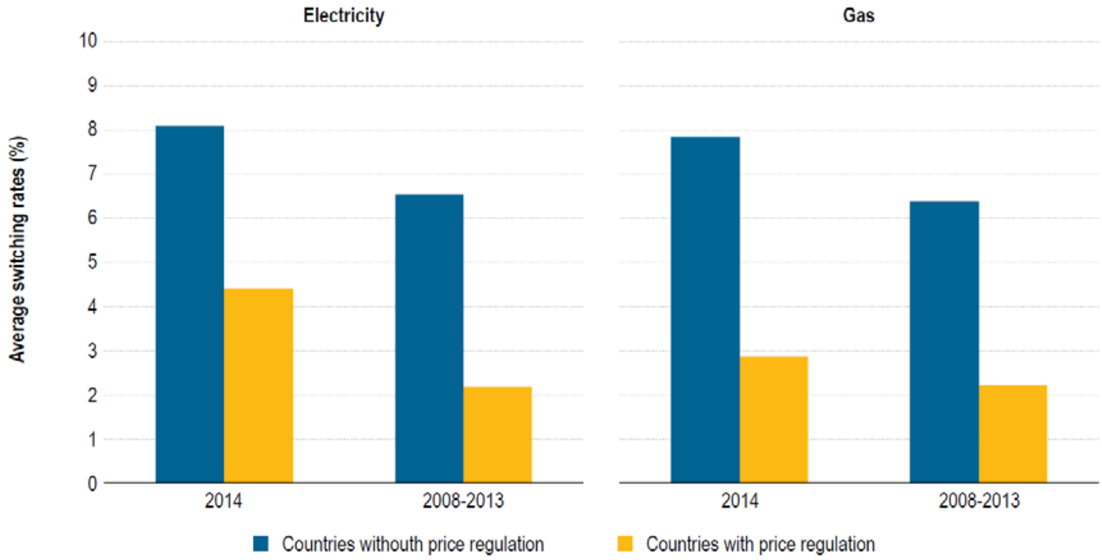
Regulated retail prices are, together with the slow implementation of smart appliances and metering systems, a major obstacle for the development of demand side response, as no proper price incentive is offered to consumers to shift (part of) their load to the most appropriate periods (e.g. high supply from solar and wind energy). Market based retail prices linked to the wholesale prices (by reflecting variations in wholesale prices in retail prices) would allow and incentivise end-users to adapt their consumption on the basis of the market situation.

74 ACER/CEER (2015)
75 EC (2015d) - COM(2015) 572
76 ACER/CEER (2015)

Energy services focusing on energy efficiency and demand response, should be developed and offered by suppliers and other market parties (aggregators, ESCO's), and be facilitated by adequate price incentives and smart appliances and metering systems, and an enabling regulatory framework. Energy efficiency and demand response should remain a major priority in Europe's energy policy. Measures that allow to reduce the peak demand and/or the overall energy demand or to shift consumption to periods with high supply from intermittent RES, allow to avoid investments in peak generation and grid capacity.

Figure 8: Switching rates in countries with / without regulated prices

Average rates in 2008-2013 and 2014 (%)



Source: ACER/CEER (2015)

5. TRANSMISSION AND INTERCONNECTION GAS AND ELECTRICITY INFRASTRUCTURE

KEY FINDINGS

Sufficient transmission and interconnection capacity is a key prerequisite for well-functioning and integrated electricity and gas systems and markets; it allows for the sharing of reserve capacity amongst TSOs and the ability to economically optimise cross-border energy flows.

At the moment, the interconnection capacity between most MSs is still rather limited, leading to congestion and a suboptimal market functioning.

For electricity, an interconnection capacity target of 10 % should be reached by 2020, but not all MSs are expected to reach it on time.

For gas there is no explicit target, but interconnectors are an essential instrument for meeting the security of supply standards.

In order to stimulate investments in electricity and gas interconnection capacity, Projects of Common Interest (PCIs) have been identified that benefit from improved regulatory conditions, accelerated permit granting and access to financial support. However, the implementation of cross-border projects remains complex, especially regarding cost allocation and alignment of national legal or regulatory provisions.

This chapter focuses on the transmission and interconnection infrastructure of both gas and electricity. It discusses the main challenges regarding infrastructure, the interconnection targets for electricity and the Projects of Common Interest.

Cross-border trade of electricity and natural gas is currently limited by a lack of interconnection or transmission capacity or due to technical reasons (e.g. different quality of gas). Overall, there is a strong need for grid and pipeline infrastructure investments and increased interconnectivity, not only for market reasons but also to enhance security of supply.

Investments in new or reinforced cross-border interconnections, and in the national grid infrastructure are needed:

- To allow to economically optimise cross-border electricity and gas trade;
- To ensure electricity system security at lower cost by sharing reserve capacities and exchanging balancing energy amongst TSOs;
- To cope with more volatile electricity production and flows over larger distances in Europe and enable the integration of large wind and solar capacities;
- To remove bottlenecks in the European electricity network and facilitate markets coupling; and
- To enhance security of gas supply by integrating and interconnecting the gas supply infrastructure within Europe and with the main suppliers.

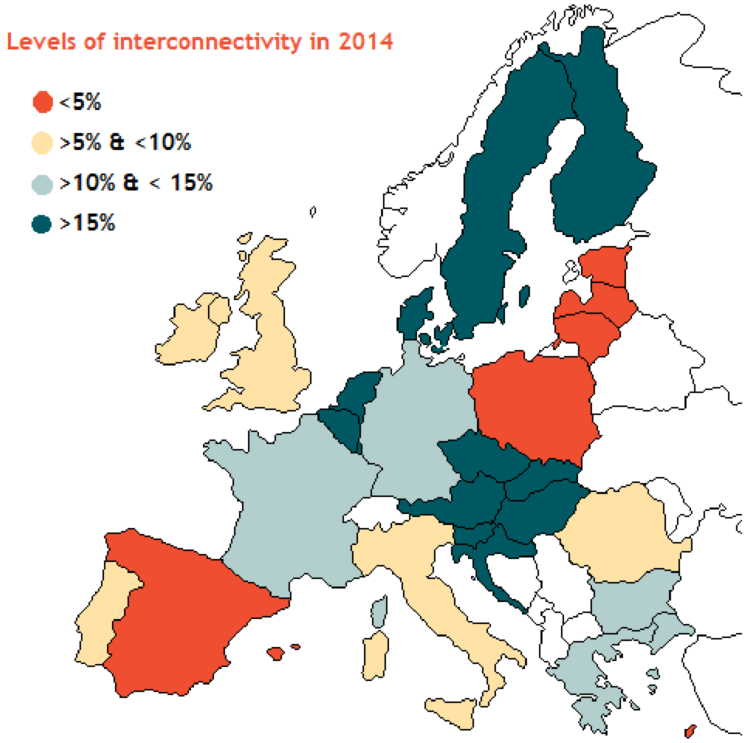
The technical infrastructure to facilitate integration of national markets (HV grids, gas pipelines, etc.) has already been substantially extended, reinforced and adapted (e.g. reverse flows for gas pipelines) but further investments are needed to reach the macro-economically optimal market integration level. Also, a key challenge regarding infrastructure is setting an adequate target level for interconnection capacity that enables a well-functioning internal energy market. A fixed and uniform electricity interconnection

target for all MSs is not an adequate solution as the optimal interconnection levels depend on several criteria that are different per MS and evolve over time, e.g. security of supply, competition, complementarity between demand curves and generation parks in neighbouring MSs, etc.

5.1. Interconnection target and levels for electricity

The European Council agreed in 2002 on a common target that each MS should have by 2020 an **interconnection capacity of at least 10 %** of its installed electricity production capacity.[77] The interconnection capacity has indeed increased since 2002 but the necessary investments to effectively achieve the 10 % target are considerable, according to a recent Communication by the Commission.[78] In 2014, eight MSs were still below their target of 10 % and would benefit of market integration by an increased interconnection capacity.[79] The average interconnection level is currently about 8 %. Figure 9 provides an overview of the individual levels per MS. It is clear that some European countries are still poorly interconnected such as the Baltic States and the Iberian Peninsula.

Figure 9: Levels of interconnectivity in 2014



Source: Adapted from COM(2015) 82 final

The Commission estimated in 2015 that the investments needed to reach the 10 % target would amount to EUR 105 billion. While EU funding is available (see section 6.1), it is unlikely that all TSOs have the capacity to finance their share of the required investments. Furthermore, given the complexity of interconnector projects, TSOs tend to give priority to national transmission infrastructure. A study by RAP proposes to finance interconnectors via open tenders in which TSOs and private investors would compete for the development

[77] Barcelona European Council (2002)
[78] EC (2015b) - COM(2015) 82
[79] EC (2015e) - SWD(2015) 243

of new projects.[80] This approach might reduce the overall costs and facilitate the access to finance, but it would lead to additional complexity.

Taking into account the importance of interconnectors for strengthening security of supply and facilitating cross-border trade, the European Commission proposed in 2015 to increase the current 2020 interconnection target of 10 % to 15 % by 2030.[81] In 2016 the Commission will in principle report on the necessary measures to reach a 15 % target by 2030.

The European Parliament has also stressed the importance of adequate interconnection targets and called for open access and availability of interconnectors.[82] Structural congestion at the border can occur if investments in network capacity are not realised in a timely manner. Therefore, the European Parliament recommends a holistic approach when assessing the need for interconnections making best possible use of both national infrastructure and interconnection lines. The European Parliament also states that fast implementation of interconnector projects is necessary which could be facilitated by a 'one-stop shop' permitting procedure which is already implemented in some MSs. It encourages the assessment of the potential of a single 'one-stop shop' at EU level for cross-border projects.

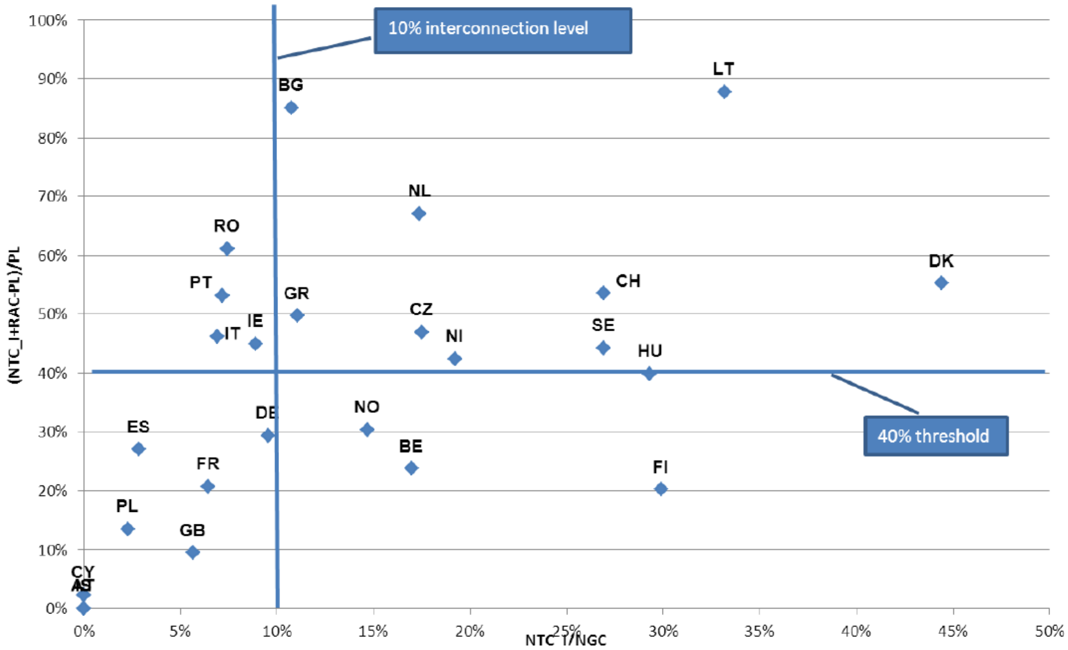
According to our analysis the current target setting for electricity interconnection capacity (1 uniform target for all MSs, expressed as a percentage of their total generation capacity) is not the most adequate approach, as it does not take into account the specificities of the individual Member States. It would be better to determine differentiated and more economically underpinned indicative targets per group of MSs (regional approach), based on the potential benefits of additional cross-border trade (including balancing energy) between the considered MS and the contribution of additional interconnection capacity to their security of supply (e.g. sharing of reserve capacity). The optimum interconnection level would depend on the ratio between the installed generation capacity and the (overall or residual) peak demand[83], the share of flexible sources and intermittent RES in the generation parks of the concerned MS[84], the complementarity of their demand curves and power generation parks, and the respective price levels (price differentials) among other aspects.

DIW Berlin proposes, as an alternative to the current interconnection target (expressed in % of installed generation capacity), an index of residual supply capacity to peak load.[85] Countries that score low on the proposed indicator are highly dependent on imports to meet their peak load and hence the level of interconnection capacity that is available for import is highly important for them. In the DIW study, a threshold of 40 % is used to evaluate the situation. In the graph below, an overview of the performance of the MSs on both indicators is given: Poland, the United Kingdom, France, Estonia, Austria, Cyprus[86] score poor on both criteria. The study also assessed the different regions based on their price integration level[87]: several countries still have a low integration level with their neighbours (Italy, Hungary, Romania, Poland), while others are highly integrated with one

[80] Baker (2015)
[81] EC (2014c) - COM(2014) 330
[82] EP (2015)
[83] MSs with a negative or low reserve level are dependent on import capacity to ensure their security of supply
[84] MSs with a high share of intermittent RES capacity and « must run » units in their power generation park can in principle benefit more from a high interconnection capacity than MSs with a highly flexible generation park
[85] Mezősi, Pató & Szabó (2015)
[86] Germany's interconnection level is slightly below 10%, which represents however, taking into account its large generation park, a huge capacity available for cross-border trade.
[87] Price integration level was measured by price convergence indicators and utilisation rate of cross-border capacity.

of their neighbours but are less integrated with the rest of Europe and form energy islands (Portugal & Spain, United Kingdom & Ireland).

Figure 10: Performance against 10 % target & "residual supply capacity to peak load"



Source: Mezősi, Pató & Szabó (2015)

Despite the fact that differentiated and economically underpinned targets result in more complexity compared to the current simplified target setting, this approach is more likely to meet the electricity system and market needs.

5.2. Interconnection capacity for gas

For gas there is no explicit interconnection target at the present, but it is clear that well-interconnected gas systems and markets provide substantial benefits deriving from price effects and increased security of supply.

For market integration to occur effectively, the availability of sufficient interconnecting infrastructure between markets is key, together with an enabling legal and regulatory framework to allow and foster trade.

Interconnectors are an essential instrument to meet the N-1 infrastructure standard foreseen in the Gas security of supply Regulation 994/2010. To achieve this "N-1" security of supply infrastructure standard across all EU member states, Booz and Company have calculated that an investment of EUR 1.5 to 3 billion in supply infrastructure would be required, on top of the investments reported by ENTSO-G (>10 billion EUR up to 2022), for which a financial investment decision has been taken.[88]

[88] Booz & Company, Benefits of an integrated European Energy market, Study of 20 July 2013 for DG Energy

5.3. Priority corridors & electricity and gas infrastructure Projects of Common Interest

5.3.1. Priority corridors

The EU has identified a number of priority corridors of electricity, gas and oil under its Trans-European Energy Networks (TEN-E) strategy in order to help build and finance important energy infrastructure. These corridors aim to strengthen cross-border interconnections and connect countries isolated from European energy markets through infrastructure development. Regulation (EU) 347/2013 sets guidelines for the development and interoperability of the energy infrastructure priority corridors.[89]

5.3.2. Electricity and gas infrastructure Projects of Common Interest

To speed up the development of a pan-EU gas and electricity infrastructure, the European Commission supports a selection of priority infrastructure projects referred to as **Projects of Common Interest (PCIs).**[90][91] These projects, based on the priority corridors, need large investments and are likely to prove complex due to their cross-border nature. The list of projects is updated every two years and the latest update was finalised in November 2015.[92]

PCIs can benefit from accelerated licensing procedures by having a single national competent authority acting as a one-stop-shop for permitting procedures, improved regulatory conditions and cost-allocation, lower administrative costs thanks to a more streamlined environmental assessment procedure, as well as increased transparency, public participation, visibility and attractiveness for investors.[93]

PCIs can also benefit from access to financial support totalling EUR 5.85 billion from the Connecting Europe Facility (CEF) between 2014 and 2020 (see next chapter). Projects that are not commercially viable but have a positive impact on security of supply, for example, are eligible for grants while all PCI projects are eligible for financial instruments (e.g. equity instruments, debt instruments, etc.).

In electricity, the PCIs are likely to bring Europe close to the achievement of the 10 % interconnection target.[94] Figure 11 illustrates the situation in 2020 in case the implementation of PCIs is successful.

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89 Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009

90 Regulation 347/2013 introduced the "Projects of Common Interests" (PCIs)

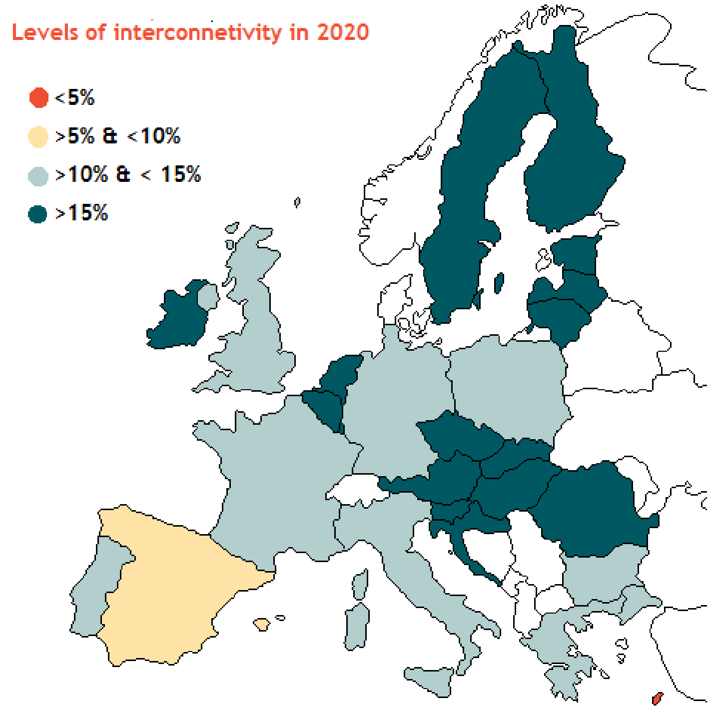
91 E.g. the interconnection between Lienz (AT) and Veneto region (IT) ; the interconnection between Zeebrugge (BE) and the vicinity of Richborough (UK) ; the physical reverse flow at Moffat interconnection point (IE/UK); and the construction of new storage facility on the territory of Bulgaria. See Regulation (EU) 2016/89 of 18 November 2015 for a full list of the projects of common interest.

92 EC (2015g) - C(2015) 8052

93 Norton Rose Fulbright (2015)

94 GR (2014)

Figure 11: Expected levels of interconnectivity in 2020



Source: Adapted from COM(2015) 82 final

As mentioned in Chapter 4.2, there is no explicit quantitative target for the interconnection of 'national' gas infrastructure, but the Security of Gas Supply Regulation 994/2010 is encouraging TSOs and MSs to consider an increased interconnectivity as one of the options to meet the N-1 infrastructure standard.[95] Investments in interconnection infrastructure (reverse flows, new interconnectors) mitigate the supply risks and allow the Union to further diversify its natural gas sources, and provide a greater flexibility in transporting gas where it is needed.[96] From an internal market perspective, grid investments and technical adaptations (harmonisation of gas quality, reverse flows) should mainly focus on the bottlenecks that still lead to structurally diverging wholesale prices between EU countries or regions. The priority corridors and PCIs should support these investments.

The implementation of PCIs is very complex, as it requires cross-border cooperation and regulatory alignment. Conflicting national legislation is often a critical issue in cross-border projects. For each contract and agreement, besides the involved parties, at least two national regulators and/or authorities have to approve the project, requiring close cooperation.

Cooperation is also a key aspect especially regarding cost allocation. In general, it is difficult to estimate future benefits and revenues of these projects due to uncertain factors such as long term price differentials and the difficulty to quantify the impact on security of supply. At present – while Regulation (EU) 347/2013 provides guidance - there is no common European or regional framework for cost allocation and benefit identification of cross-border projects. This can hinder TSOs from developing projects that mainly benefit another area. Infrastructure projects within Europe can also have a positive impact on third country energy systems, which results in an asymmetry between cost allocation and benefit distribution.

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95 The N-1 formula describes the ability of the technical capacity of the gas infrastructure to satisfy total gas demand in the event of disruption of the single largest gas supply infrastructure, during a day of exceptionally high gas demand occurring with a statistical probability of once every 20 years.

96 EC (2011)

6. ECONOMIC INSTRUMENTS TO INCENTIVISE INVESTMENTS IN THE ELECTRICITY & GAS SECTOR

KEY FINDINGS

Large investments are needed to effectively integrate the gas and electricity systems and markets across Europe. Economic instruments have been implemented at EU level to support investments in energy infrastructure and in particular in Projects of Common Interest.

However, the wide range of EU instruments targeted at financing energy infrastructure projects overlap and are not fully consistent. Moreover, as the available EU energy funding only covers about 5 % of the overall financing needs for grid infrastructure, measures are necessary to facilitate access to other financing sources.

The strong development of subsidised RES is undermining the profitability of conventional power plants; in order to ensure generation adequacy several MSs have introduced or are assessing the implementation of a national capacity remuneration mechanism.

The lack of harmonisation and cross-border participation in CRM should be urgently addressed at EU level in order to ensure fair competition amongst capacity providers and avoid any negative impact on the completion of the internal energy market.

This chapter provides an overview of some key economic instruments that have been implemented in order to facilitate the financing of infrastructure which is needed to achieve the internal energy market. Firstly, some instruments that incentivise public investments and PCIs in electricity and gas infrastructure are discussed (CEF, EFSI, ESIF, EEPR, EEEF, Horizon 2020). Secondly, capacity remuneration mechanisms, that incentivise investments in electricity capacity, are briefly presented.

In order to achieve fully integrated electricity and gas systems and markets and to realise the transition to a low carbon and competitive energy supply while ensuring a high level of supply security, the EU requires massive investments in infrastructure to reinforce and upgrade the grid, to enhance the interconnectivity amongst MSs and regions and to accommodate the large-scale deployment of energy from renewable sources. The realisation of investments in cross-border grid infrastructure is hindered by the lack of an enabling framework with regard to cost/benefit allocation, permitting and financing rules. On the other hand, the price signals to trigger investments in not subsidised (conventional) generation capacity are not sufficient, especially for peak load or back-up generation capacity. Current market prices and rules are also not sufficiently incentivising investments in flexibility (flexible supply, demand response and storage).[97] In 2014, the EU Task Force on Investment warned that regulatory, financial and political obstacles can delay or prevent funding for vital infrastructure for the Energy Union[98]. Energy infrastructure projects require long lead times and large investments, and the lack of an enabling regulatory framework (in particular for cross-border projects) diminishes investors' confidence.

In 2011, the Commission estimated that EU wide about EUR 200 billion of investment would be needed by 2020 in energy transmission networks.[99] In 2014, the International

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97 EC (2015j)
98 Euractiv News (09 Dec 2015), 'Barriers to infrastructure investment blocking Energy Union'. Retrieved from: http://www.euractiv.com/sections/energy/barriers-infrastructure-investment-blocking-energy-union-310695
99 EC (2011)

Energy Agency (IEA) stated that the total investment needed for electricity and gas networks in the EU would rise to EUR 931 billion in the period 2014-2035.[100] These investments should be realised – to a large extent – by the private sector, but access to finance will be key.

Although there is a clear need for transmission and interconnector investments, the realisation is lagging. Key challenges are:

- To facilitate access to finance and mitigate investors' risks by appropriate instruments;
- To develop an enabling regulatory framework and methodology for cost/benefit allocation of cross-border infrastructure investments;
- To bring coherence in the wide array of funding schemes and optimise their impact; and
- To increase private finance for energy infrastructure.

Other specific challenges for investments in the energy sector (power generation and electricity and gas infrastructure) are[101]:

- The global financial and economic crisis has slowed down the pace of investments;
- ETS is not giving the correct price signal and hence does not trigger investments in low-carbon technologies;
- Energy infrastructure projects are capital intensive, requiring long lead times and huge investments up-front;
- Advanced technologies such as new types of electricity storage and smart energy systems are still under development and not yet available at feasible economic terms on a large scale;
- Low private investors' confidence mainly due to frequent changes in legislation and a lack of visibility of the long term market and regulatory framework;
- Fragmentation of financial markets;
- Difficult access to risk capital to catalyse investment;
- Access to credit is also difficult, especially for long-term financing of projects in MSs strongly affected by the crisis;
- Large infrastructure projects are highly dependent on bank debt, which is a risk in case of a banking crisis;
- Complicated and uncertain procedures for project funding, especially with regard to financial support for construction works.

6.1. Instruments for facilitating investments in energy infrastructure and projects of common interest (PCIs)

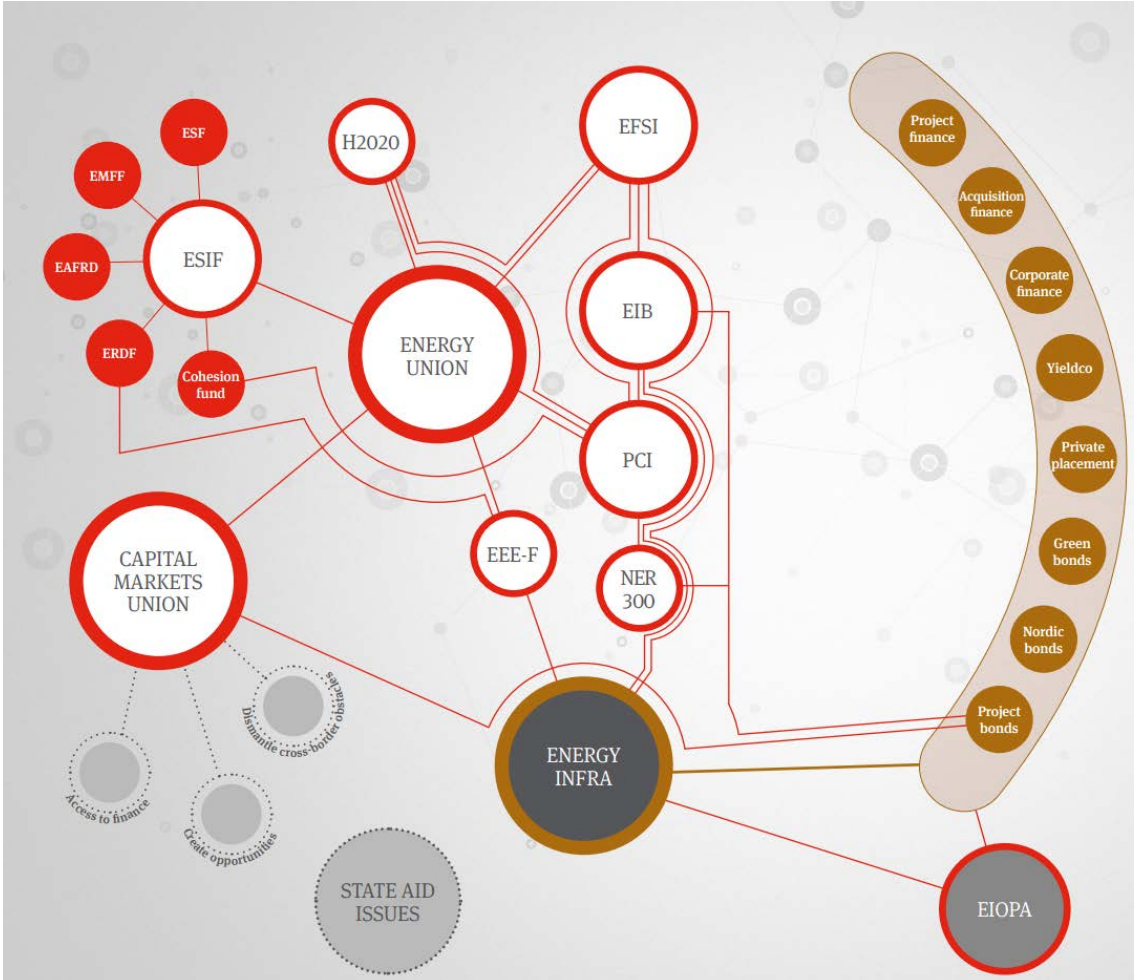
A number of instruments have been put in place by the European Union in order to address the identified barriers and support the development of energy infrastructure projects. These are not only providing financial assistance, but also supporting and accelerating the planning and permit granting procedure (in the case of projects of common interest, or PCIs) and promoting awareness of viable projects (Juncker plan).[102]

[100] European Court of Auditors (2015)
[101] Scott et al (2015) and Norton Rose Fulbright (2015)
[102] Norton Rose Fulbright (2015)

The main instrument is the Connecting Europe Facility (CEF) which provides financial support to Projects of Common Interest and the European Fund for Strategic Investments (EFSI). A study by RAP argues that only a small number of crucial projects should be funded by CEF and EFSI and the rest should be funded through regulated income or merchant projects.[103]

These and other instruments that support projects which are not bankable under pure market conditions are presented in more detail below and are illustrated in Figure 12.

Figure 12: EU initiatives and programmes c supporting energy infrastructure



Source: Norton Rose Fulbright (2015)

6.1.1. Connecting Europe Facility

The **Connecting Europe Facility (CEF)** is an EU initiative for targeted infrastructure investments in transport, energy and critical digital networks. Under the CEF initiative a budget of EUR 5.85 billion has been allocated to trans-European energy infrastructure (TEN-E) for the period 2014-2020. The EU financial support focuses on the Energy Union, in particular, completing the internal energy market, ensuring security of supply, promoting sustainability (e.g. by facilitating transmission and distribution of renewable energy) and attracting public and private investments.

Projects which can be financed by CEF must be listed as Projects of Common Interest (PCIs). The bulk of the funds are available for grants whereas a maximum of 10 % is set

[103] Baker, P. - RAP (2015)

aside for financial instruments (e.g. enhanced loans, project bonds and equity instruments).

Grants are available for construction works (for projects that are not commercially viable but are socio-economically beneficial) and for studies. The grants aim to mobilise additional private and public funds towards the selected investments. For PCIs to be eligible, they must meet a number of criteria. In May 2014, the first call for proposals under the CEF was launched, allocating EUR 647 million worth of grants to 34 proposals for key energy infrastructure projects.[104] In 2015, EUR 650 million is set aside for grants for PCIs, with the first call for proposals allocating EUR 149 million to 20 proposals.[105]

A construction work can receive CEF funding if it demonstrates that:

- "it offers significant benefits, such as security of supply, solidarity between Member States or innovation;
- It is commercially not viable;
- It has been subject to a cross-border cost allocation; in some cases, a big part of an investment needs to be made by project promotors in one Member State while the main benefits are for another Member State. In this case a decision on sharing the costs needs to be taken by the competent regulatory authorities."[106]

Financial instruments such as enhanced loans, project bonds and equity instruments are made available to the PCIs in cooperation with international financial institutions, such as the European Investment Bank (EIB) for debt and the Marguerite Fund[107] for equity.[108] In the 2014-2016 period, priority will be given to PCIs aimed at completing the energy market. It is expected that CEF financial instruments will leverage 6 to15 times the funds provided.

6.1.2. European Fund for Strategic Investments

Some of the interconnection projects needed to achieve the energy market integration will be **financed through the European Fund for Strategic Investments (EFSI)**.[109] EFSI aims to bring together EUR 315 billion from private and public investments by the end of 2017. Potentially EUR 240 billion of the EUR 315 billion Juncker plan will be assigned to energy and energy infrastructure.[110]

Along with EFSI, the Commission will create the European Investment Project Portal (EIPP). The EIPP will be a publicly available, secure web portal where EU based project promoters seeking external financing are given the opportunity to promote their projects to potential investors.

6.1.3. European Structural and Investment Funds

The new Cohesion Policy (2014-2020) supports the Europe 2020 strategy and aims to reduce development disparity across regions. From 2014 to 2020, EUR 50 billion (EUR 630 billion including national co-financing) will become available for investment as part of the

[104] EC (no date, a)
[105] DG ENER website: https://ec.europa.eu/energy/en/topics/infrastructure/projects-common-interest
[106] EC (no date, a)
[107] The 2020 European Fund for Energy, Climate Change and Infrastructure ("Marguerite") was established with the backing of six major European financial institutions to support capital-intensive infrastructure investments.
[108] EC (no date, a)
[109] Regulation (EU) 2015/1017
[110] Norton Rose Fulbright (2015)

European Structural and Investment Funds (ESIF).[111] This means that regions and Member States must target EU investments in 11 areas for economic growth and job creation including "Supporting the shift towards a low-carbon economy". The latter investment area, with more than EUR 27 billion allocated, will also allow for the channelling of funds to the aims of the Internal Energy Market. It is anticipated that cohesion policy funding will act as a trigger to leverage private funding.

The ESIF rules[112] govern the investments for 2014-2020 under the 5 structural and investment funds:

- European Regional Development Fund
- European Social Fund
- Cohesion Fund
- European Agricultural Fund for Rural Development
- European Maritime & Fisheries Fund

Box 4: Accessing ESIF Funds

Member States manage 75 % of the funds (with the remaining 25 % managed directly by the EC). MSs must submit, after consultation, 'strategic plans with investment priorities' outlining how the five funds will be used. Once the plan is negotiated and approved by the EC, the MSs can establish their Operational Programmes which are then implemented by the Member States' managing authorities. These authorities select, implement, monitor and evaluate the specific projects. Project eligibility varies depending on the MS selection criteria and Operational Programmes

The key funds for energy projects are the European Regional Development Fund and the Cohesion Funds.[113]

The **European Regional Development Fund (ERDF)** aims to reduce economic disparity across EU regions. The minimum expenditure for projects supporting the low carbon economy differs according to the level of development of the region. 20 % of the national ERDF funds should be spent in low carbon economy projects in developed regions, 15 % in transition regions and 12 % in less developed regions. ERDF should support investment in increasing use of renewable energy, decreasing energy use, promoting smart energy systems, and encouraging an integrated approach to policy-making and implementation.

The **Cohesion Fund (CF)** aims to reduce economic and social disparities and to promote sustainable development. It is available for Member States whose Gross National Income per inhabitant is less than 90 % of the EU average.[114] The CF allocates EUR 63.4 billion to trans-European transport networks and environment related activities. The CF can support activities in the energy sector such as co-generation, district heating networks, smart energy distribution, storage and transmission systems.

6.1.4. Horizon 2020

The successor to Framework Programme 7 is **Horizon 2020**, which will also continue parts of the Intelligent Energy Europe and other energy relevant parts of the Competitiveness and Innovation Framework Programme. One of the seven societal challenges is secure,

[111] EC (2014f) - COM(2014)903
[112] Regulation (EU) No 1303/2013
[113] The EAFRD might provide some relevant funding to projects if these are located in rural areas.
[114] The Member States eligible in the 2014-2020 funding period are: Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia and Slovenia

clean and efficient energy. There are seven specific objectives and research areas under this heading:[115]

- Reducing energy consumption and carbon footprint
- Low-cost, low-carbon electricity supply
- Alternative fuels and mobile energy sources
- A single, smart European electricity grid
- New knowledge and technologies
- Robust decision-making and public engagement
- Market uptake of energy and ICT innovation.

A budget of EUR 5.9 billion has been allocated to these non-nuclear energy research topics for the period 2014-2020.

6.1.5. Evaluation of the considered instruments

A variety of instruments to incentivise investments in energy infrastructure and PCIs is currently in place at EU level. These instruments overlap to a certain extent across the different programmes (energy efficiency, renewable energy and interconnectors) resulting in inefficiencies and a lack of transparency. An alignment of the instruments under the Energy Union umbrella would offer benefits, such as reduced administrative costs, easier access for investors and greater transparency. The European Court of Auditors suggested in 2015 that PCI projects should continue to be prioritised and funded, but this should be done according to a comprehensive EU-level energy infrastructure needs assessment.[116] Moreover, processes for access to funding should be simplified and streamlined where possible. This should allow investors to have a better overview and understanding of the different instruments and lead to a more efficient use of resources.

Investors also need an accessible and transparent overview of cross-border public sector investments at EU level and their status. The European Investment Project Portal (EIPP) – which is not yet online but has been designed by regulation (EU) 2015/1017 - aims to address this issue.

The different financing instruments should be backed by a clear and harmonised regulatory framework, in particular for cross-border investments, in order to offer high transparency, coherency and efficiency. An increased mobilisation of public and private capital is needed to facilitate the financing of investments in energy infrastructure in the EU.[117] This could be done, for example, by lengthening time horizons of institutional investors[118], by developing specific financing instruments at EU level (e.g. bonds) and by providing a stable regulatory framework for investors.

The Commission estimated that approximately EUR 200 billion would be needed for investments in the electricity and gas transmission networks by 2020.[119] However, EU funds allocated to energy infrastructure for the period 2007-2020 amount to only EUR 11 million (including TEN-E, EEPR, CEF energy and ESIAF) which is only 5 % of the required investments.[120] A significant gap remains between the EC funding and the overall financing needs. A raise in the budget would be appropriate, but other solutions should also be

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[115] Horizon2020 website: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/secure-clean-and-efficient-energy

[116] European Court of Auditors (2015)

[117] Scott et al - Friends of Europe (2015) and Green Growth Platform (2015) "Financing a Low Carbon Energy Union"

[118] Trinomics (2015)

[119] European Court of Auditors (2015)

[120] European Court of Auditors (2015)

considered. In order to ensure that the crucial projects are actually developed, CEF and EFSI funding could give priority to these projects.[121] Grants could be "combined with the efforts of regulatory authorities to finance projects through network tariffs and other funding sources."[122] 'Regular' grid investments should in general be funded through revenues form regulated grid tariffs while merchant projects can be funded through congestion revenues or bilateral contracts. EURELECTRIC recommends that the "PCI process should focus on efficient performance, prioritising cost-efficient alternatives and taking into account novel approaches".[123] Furthermore, the association states that grid projects should only be implemented when they have a positive macro-economic cost–benefit analysis (CBA), noting the importance of having an adequate CBA.[124]

It is obvious that any public investment in infrastructure should indeed only be considered if it provides social welfare; for this reason we are not in favour of a fixed interconnection target for all MSs but we would recommend differentiated interconnection targets per group of MSs (regional markets) based on comprehensive macro-economic assessments.

6.2. Capacity remuneration mechanisms to incentivise generation capacity investments

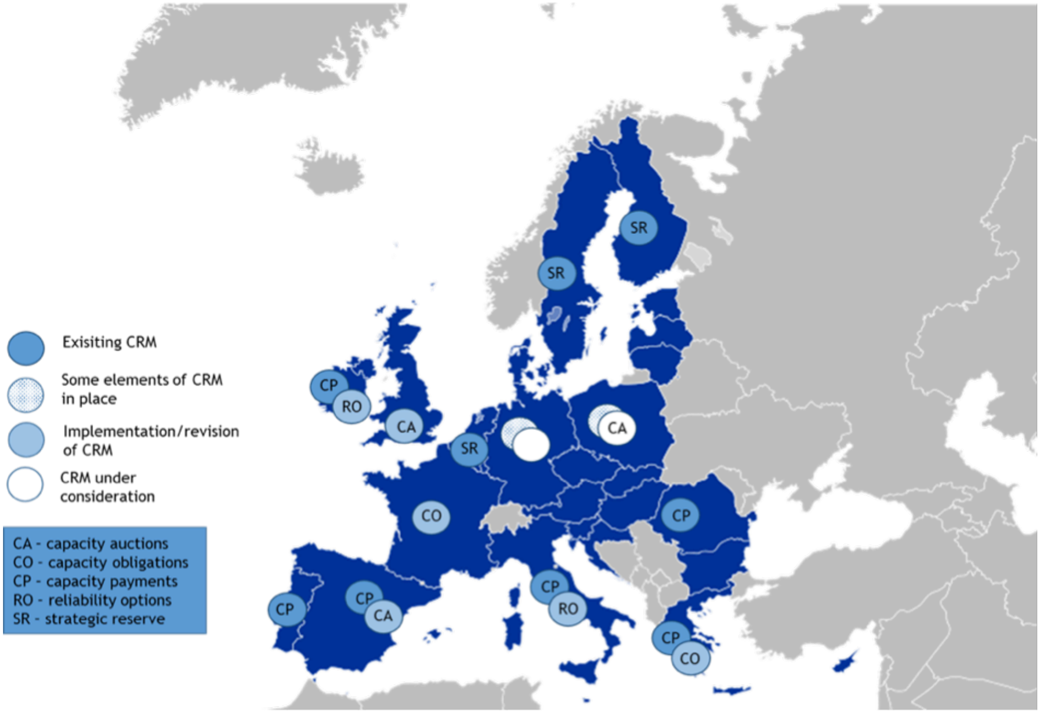
Several MSs have introduced or are considering capacity remuneration mechanisms (CRMs) as an instrument to ensure that the available generation capacity is sufficient to cover electricity demand at all times.[125] Due to **market and regulatory failures in the electricity market**[126] the market does currently not provide a sufficient remuneration level to cover the fixed cost of conventional generation capacity; in this context investment projects in new (not subsidised) capacity are put on hold and existing conventional power plants are prematurely decommissioned for economic reasons. Capacity remuneration mechanisms provide an additional revenue stream for electricity producers via a capacity-based payment, which allows them to recover (part of) their fixed costs. Depending on the scheme, CRMs provide an investment incentive for new capacity and/or a capacity payment to keep existing power plants available to the market and/or to the system operator. In some schemes, reduction in peak load (demand response) and RES capacity are also eligible for capacity payments to the extent that they contribute to covering peak demand.

As discussed in our case study (see Annex 4), different types of CRMs exist across Europe, all with their specific design elements and characteristics.

Figure 13 shows an overview of the types of CRMs that are currently implemented or are considered in the EU.

[121] Baker, P. - RAP (2015), EC (no date, a)
[122] EC (no date, a)
[123] EURELECTRIC (2015a)
[124] EURELECTRIC (2015a)
[125] In Annex 3 a comprehensive case study on capacity remuneration mechanisms is presented.
[126] Market and regulatory failures include inelastic electricity demand, electricity price caps imposed by authorities or regulators, decreasing profitability of conventional power plants due to the impact of (subsidised) intermittent RES on the price formation (merit order effect) and on the load factor.

Figure 13: Capacity mechanisms in Europe in 2015



Source: based on Hancher, De Houteclocque & Sadowska (2015)

The analysis in our case study on capacity remuneration mechanisms shows that uncoordinated national CRM initiatives can lead to competition and market distortions, and hinder the completion of the internal energy market. Bidding processes in the electricity (cross-border) wholesale and balancing markets will be affected by national policies that provide capacity payments to specific technologies or to capacity located within the national borders. National financial support to existing uneconomic assets can also have an impact on the price formation and hinder the transition to a low carbon electricity supply. The impact of CRMs on the IEM is dependent on the type of CRM and its concrete operation rules. CRMs that are not market-based can result in an inefficient level of capacity investment. Also, CRMs that are not market-wide (e.g. when only specific technologies are eligible to participate) will lead to competition distortion. Furthermore, the impact of the CRM on the IEM is dependent on the extent to which cross-border participation is allowed. If cross-border capacity is not taken into account in the design of the CRM, the market outcome and investment level will be suboptimal and there will be a shift of generation capacity towards the country with CRM.

Adequate investments in generation capacity should first of all be stimulated by a favourable and predictable investment climate and by properly functioning markets without price regulation. If price signals from the energy-only market do not trigger timely investments in power generation capacity to ensure security of supply, the introduction of capacity remuneration mechanisms can be considered; in that case preference should be given to an EU-wide scheme or at least a harmonised scheme on a regional level. At this stage, implementing an EU-wide CRM is not a feasible option, due to the fact that national CRMs already exist and taken into account the national specificities in the energy and technology mix and the diverging energy policies. Based on the current experiences and the analysed studies, four major elements should be taken into account when implementing a CRM:

- **Market-based:** An efficient capacity remuneration mechanism will positively affect the capacity reserve margin which in turn will have a decreasing effect on the market price (less and lower price peaks), and restrain new investments in capacity. For that reason, a market-based CRM is the most appropriate solution; in such a scheme the capacity payment which is determined by the market, automatically reflects the scarcity level and keeps the demand-supply level structurally in balance. If authorities or regulators determine the capacity payments administratively, they will not reflect the scarcity of capacity, and might lead to cyclical over- or undersupply.
- **Market-wide:** All technologies should be eligible to participate in the CRM, including storage, DSM and the de-rated capacity of RES. In this way the distortion of competition will be limited. Also capacity that already receives support via another instrument (e.g. RES support mechanisms) should be included, but the support should be adjusted in order to avoid overcompensation.
- **Open for participation of cross-border capacity:** Preferably, foreign generation/storage or demand response capacity should be able to participate in the CRM. This will necessitate adequate coordination amongst authorities and regulators and also TSOs will need to closely cooperate to determine the possible contribution of foreign capacity to the system reliability, and to agree on the calculation and allocation rules of cross-border grid capacity.
- **Harmonised (or unique) CRM at supranational (regional) level:** More coordination and harmonisation of policies and market rules at regional level is necessary to avoid market and competition distortions and to ensure security of supply at the lowest cost. In this context harmonised or even a unique CRM at supranational level would be more appropriate than diverging national CRMs.

7. KEY FINDINGS AND RECOMMENDATIONS

7.1. Key findings

1. Electricity and gas markets' integration provides substantial macro-economic benefits, but regional implementation projects are delayed, mainly due to inadequate governance

The main objective of market integration is to increase social welfare through enhanced competition at supranational level, improved competitiveness, higher security of supply, and facilitated market integration of RES production. To integrate the energy markets, several regional projects have been launched (such as development of gas hubs and market coupling for electricity) and are being implemented across Europe. The governance process is however a critical issue: the **decision and implementation processes are complex and very time-consuming**, mainly due to the fact that national governments, TSOs and regulators are primarily responsible for their national energy system/market and are not a priori motivated to take other constraints and benefits into account. There is **a lack of strong regulatory oversight and governance at supranational/EU level** to steer and accelerate the process. Parties are cooperating on a voluntary basis and without hierarchy or external arbitrage. For this reason, the process to agree on and implement a common approach is lengthy, difficult and intricate and often leads to implementation delays or suboptimal solutions.

2. Diverging national energy policies and market rules are still hindering market integration

As a result of the integration of national markets and increased physical interconnections, markets are more sensitive to distortions in cost structure and pricing resulting from **diverging national energy policies**. Differences between national taxes, grid access rules and tariffs, levies and other charges on power generation and storage have an impact on investments and operational decisions (merit order) and can **distort competition between market parties in different member states and hence hinder market integration**. Specific national measures to enhance security of supply or to stimulate the development of low carbon technologies, in particular support schemes for renewable energy and capacity remuneration mechanisms (CRMs), are another example of possibly diverging national energy policies which can lead to competition distortion and hinder market integration.

3. EU legislation is often not implemented in a timely or correct way and non-compliance of national legislation is not effectively addressed by European institutions

Non-compliance of national legislation with EU legislation is a frequently occurring and major problem: evidence of this is provided by the fact that the Commission has opened 38 infringement proceedings against 19 MSs for non-disposal or partial disposal of the Directives under the Third Energy Package. In general these procedures take a substantial length of time before they effectively lead to results. Incomplete or incorrect national implementation of EU regulation implies **market and competition distortions**, and is currently not rapidly and efficiently addressed. Our case-study on the wholesale gas market

in Hungary illustrates that non-compliant national legislation (gas interconnection capacity allocation methodology) could be maintained in Hungary for more than 4 years.

4. Electricity wholesale prices were increasingly converging since the market coupling, but since 2013 this trend has been negatively impacted by changes in the energy mix, and in particular the strong development of wind and solar energy in some MSs

Our case studies on day-ahead market coupling in the CWE and CEE region show that the implementation of electricity market coupling initially led to a substantial increase in price convergence, but this positive evolution stopped in 2013. Since 2013 the price convergence has been negatively impacted by the evolution in the power generating mix, including the gradual phase out of nuclear energy, and the **strong development of RES** (wind and solar energy) in some, which has resulted in large electricity flows to neighbouring countries, resulting in more **congestion at the borders and increasing price divergence**.

5. Current electricity market functioning is not adapted to increasing volumes of variable renewable energy sources

The share of intermittent RES in the electricity mix has significantly increased in the past few years. However, the organisation of the electricity market is not yet adapted to this shift and the electricity system and market have **difficulties accommodating the increasing share of fluctuating RES generation** (mainly solar and wind energy). **Flexible resources (in particular DSM and storage) are not yet sufficiently developed** as a result of inadequate end-user pricing formulas, the lack of balancing responsibility for RES generators in some countries and the lack of an enabling regulatory framework. The **development of cross-border intraday and balancing markets is also slow**, while the integration of these markets could offer substantial benefits for the development of RES.

6. Some electricity and gas retail markets have become very competitive and dynamic but in many countries consumers cannot yet fully benefit from proper competition amongst suppliers and market based prices

Even though cross-border integration of neighbouring retail markets might offer macro-economic benefits (economies of scale, enhanced competition), retail markets **remain mainly organised at national level** in most countries. Some retail markets have become very competitive and show high supplier switching rates, but in many countries there is still a lack of proper competition and **consumers do not play an active role in the energy market** (e.g. by switching supplier or by demand response). Barriers to supplier switching are insufficient monetary gains, lack of trust in a new supplier and the perceived complexity of the switching process (e.g. administrative burden). The development of energy services (e.g. for demand response) is still limited due to a lack of proper price incentives (e.g. wholesale market based prices) and smart metering systems, regulatory interventions (price regulation, energy taxes/surcharges and grid fees) and a lack of appropriate information on costs and consumption, and/or a lack of transparency in offers.

7. Interconnection capacity calculation and allocation processes have substantially improved, but markets' functioning and integration in some MSs are still hindered by non-market based allocation mechanisms

The introduction of **flow-based interconnection capacity calculation** for electricity and the implementation of **market based allocation procedures** (e.g. auctions) for both electricity and gas, facilitate and improve the market integration process. These improvements increase the interconnection capacity which is effectively available to market parties, and to maximise/optimise its use. The best practices have been identified but are not yet implemented in all European regions. For example, our case study on the Hungarian wholesale gas market shows that the gas interconnection capacity at one entry point in Hungary was in 2011-2014 not allocated via a market procedure but was granted exclusively to two trade companies; this political intervention led to competition distortion and hindered the access to (cheaper) Western gas resources for other gas traders, which were eventually forced to leave the market.

8. Interconnection levels have increased for both electricity and gas, but the available capacities are still insufficient to ensure fully integrated electricity and gas markets

Sufficient transmission and interconnection capacity is a key prerequisite for well-functioning and integrated electricity and gas systems and markets; it allows the sharing of reserve capacity amongst TSOs and the economic optimisation of cross-border energy flows. At the moment, the **interconnection capacity between most Member States is still rather limited**, which leads to congestion and suboptimal market functioning. With regard to electricity interconnection capacity, a target level of 10% has been set for 2020, but not all countries are expected to achieve this target. In order to speed up investments in transmission and interconnection infrastructure, **priority projects have been identified for both gas and electricity** (Projects of Common Interest). Although these projects benefit from improved regulatory conditions, accelerated permit granting and access to financial support, their **implementation remains very complex** as it requires cross-border cooperation and regulatory alignment, especially regarding cost allocation and alignment of possibly conflicting national legal or regulatory provisions.

9. The EU instruments targeted at co-financing energy infrastructure projects effectively contribute to realising investments, but the framework lacks focus and coherence

The EU has implemented several supporting instruments targeted at co-financing energy infrastructure projects. **Overlaps and a lack of coherence exist amongst the different programmes** (e.g. energy efficiency, renewable energy and interconnectors). These overlaps and incoherencies lead to **inefficiencies and a lack of transparency**. Although the Energy Union intends to bring cohesion, efforts are still needed to bring the existing instruments into a clear and comprehensive framework.

10. Available EU energy funding only covers about 5 % of the overall financing needs for grid infrastructure

The Commission estimated that approximately EUR 200 billion would be needed for electricity and gas transmission networks by 2020. However, EU funds allocated to energy infrastructure for the period 2007-2020 amount to only 11 million euro. **A significant gap**

remains between the EC funding and the overall financing needs. Adequate policies and instruments are necessary to **allow grid operators to finance the required investments** for upgrading, reinforcing and extending their infrastructure.

11. Security of supply is mainly addressed at national level, and non-harmonised national capacity remuneration mechanisms (CRMs) are being implemented with the risk of hindering the completion of the internal energy market

As a result of market and regulatory failures the electricity market doesn't provide the right price signals for electricity producers to invest in new generation capacity, and existing conventional capacity is prematurely decommissioned for economic reasons. In order to ensure generation adequacy, several Member States have decided to intervene in the electricity market by introducing CRMs, which provide a financial incentive for capacity through a specific remuneration scheme. However, **uncoordinated national CRM initiatives** that are not open for cross-border participation and that are not market-based can lead to **competition and market distortions** and hinder the completion of the internal energy market. Bidding processes in the electricity supranational wholesale markets and markets for ancillary services will be affected by national policies to grant capacity payments to specific technologies or to capacity located in their own territory. National financial support to existing uneconomic assets can also have an impact on price formation and hinder the transition to a low carbon electricity supply. A lack of harmonised rules at supranational (regional or European) level to allow cross-border participation in CRM results in the risk of higher overall costs to ensure security of supply and distortion of competition between market parties that are competing in the same integrated regional market.

7.2. Recommendations

1. Market integration should be facilitated and accelerated by stronger governance at supranational/EU level and increased coordination and cooperation amongst key stakeholders

The ongoing elaboration of EU wide network codes will improve the governance structure and support the integration of electricity and gas systems and markets. A clearer structure and stronger steering and arbitrage at EU level is however necessary to improve the process which is currently mainly based on voluntary cooperation. **Clearly defined roles and responsibilities for the different stakeholders, including an appropriate governance architecture at European level, are needed to ensure efficient market integration.**

The role of ACER should be reinforced to facilitate and accelerate market integration. Cooperation between ACER and the ENTSOs will also have to deepen as the integration of markets goes further and regulatory questions are more often of a cross-border nature. Stronger and more structured **inter-NRA and inter-TSO cooperation** as well as further integration of power exchanges and TSOs would also contribute to more rapid and efficient market integration. **The setting up of regional TSOs** to deal with cross-border issues should also be stimulated. The creation of regional TSOs with an appropriate legal mandate would facilitate the adoption of regional agreements between national entities.

Gas and electricity TSOs should be obliged to cooperate more closely in order to optimise the use of gas-fired power plants for flexibility (back up capacity for intermittent RES) and balancing purposes.

Finally, a **closer cooperation between TSOs and DSOs** is necessary as congestion management, balancing and demand response have also become relevant issues at distribution level.

2. National energy policies and market rules should be more harmonised

Although EU energy legislation, in particular the 3rd package, has led to a more coordinated approach across Europe, national options (e.g. on unbundling, energy mix, RES support schemes, grid access rules and tariffs, energy taxation and market functioning) are still diverging and hindering market integration. While this is a politically sensitive issue, European institutions should **ensure harmonised and consistent energy policies**, including measures to promote energy efficiency and renewable energy, and reduce competition distortion, including in areas of policy that are of national competence. They should also facilitate coordination and provide more transparency on taxes, charges and levies to help Member States understand their consequences, particularly on cross-border trade. Harmonised and more consistent policies will allow to realise economies of scale and to better value competitive advantages; they also will offer a level playing field which is necessary to avoid competition and market distortions.

3. EU regulation should be timely and correctly implemented by national authorities and infringements should be rapidly and effectively addressed at EU level

Incomplete or incorrect national implementation of EU regulation hinders the integration of markets and can lead to competition distortion. Therefore, full compliance of national legislation with EU regulation should be properly and effectively enforced. Lack of adequate intervention would lead to sustained violation of the EU regulation. Where infringements are presumed, the European institutions should **react swiftly and, if necessary, launch a formal enquiry in due time**. National authorities should be **rapidly forced to withdraw any national legislation that is not compliant with EU principles or legislation**.

The European Commission should also **ensure that national anti-trust policies and State aid provisions are in line with the EU internal market and competition rules**.

4. Structural price divergence may be used as one of the guiding indicators to signal a possible need for additional interconnection capacity

The observed price divergence following increased levels of RES deployment demonstrates **untapped market integration potential** which is likely to grow as more RES will be added to the European energy mix. The key to unlocking this potential is to **increase the interconnection capacity, if it has been demonstrated that the investment effectively provides a positive macro-economic outcome**. In order to identify possible needs for increased interconnection capacity it is recommended that **price divergence levels should be included as one of the guiding indicators**.

5. The target design model for the electricity market should be urgently implemented in order to accommodate increasing shares of variable renewable energy sources

In order to respond to the increasing share of intermittent RES in the electricity market, the functioning of the electricity markets needs to be adapted in order to ensure this integration at least cost. **The target design model for the electricity market should therefore be urgently implemented**. The implementation of day-ahead market coupling across Europe is a first important first step to reach this goal. **Liquid supranational intraday and balancing market platforms** should also be created, in order to allow grid operators and market parties to efficiently find counterparts for their flexibility and balancing needs. Moreover, the **deployment of flexible resources**, both at the supply and demand side, need to be stimulated in general in order to accommodate the integration of intermittent RES. Finally, **TSOs should be encouraged to procure ancillary services via cross-border market platforms**, and end-users should be allowed and stimulated to participate in this market via specific demand response products.

6. Retail markets should have a harmonised design and become more competitive and dynamic; energy and related services should be offered at market-based prices

Even though integration of retail markets is not a political priority at the moment, more **harmonisation of the retail markets' design at EU level** would be appropriate for the basic features and processes, in particular the determination of the roles and responsibilities of the different market parties (TSO, DSO, supplier, aggregator, etc.) and the requirements for data ownership, availability and exchange. Further harmonisation of market processes and rules could be assessed, amongst others, based on the experience in some European regions where retail market integration is being considered (e.g. Common Nordic End-User Market).

Retail markets should become more competitive by avoiding price regulation and establishing a closer link between wholesale prices and retail prices in order to incentivise end-users to adapt their consumption on the basis of price signals. Variations in wholesale prices should, to a certain extent, be reflected in retail prices. Consumers must be allowed and enabled to smoothly switch to another supplier; administrative barriers must be avoided and adequate processes (such as for metering data exchange) must be in place.

Energy services (energy efficiency, demand response) should be developed and offered by suppliers and other market parties (aggregators, ESCOs) and be stimulated and facilitated by adequate price incentives, smart appliances and metering systems, and an enabling regulatory framework. Energy efficiency and demand response should indeed remain a major priority in Europe's energy policy. Measures that allow the reduction of peak demand and/or the overall energy demand or to shift consumption to periods with high supply from intermittent RES, allow investments in peak generation and grid capacity to be avoided.

7. The commercially available interconnection capacity should be maximised and its allocation should be market-based and non-discriminatory

The flow-based methodology for electricity interconnection capacity calculation should gradually be implemented by all TSOs in Europe. Capacity reservations by TSOs for security purposes should be minimised and all available capacity should be allocated, both for

electricity and gas, via **market-based and non-discriminatory processes**. Any reserved but unused capacity should be made available to other market parties, either via implicit auctions (market coupling) or via market platforms.

8. Need for adequate and economically underpinned interconnection targets for electricity and gas

The current target setting for interconnection capacity for electricity is not the optimal approach. **More differentiated and economically underpinned targets** should be considered, which could be **based on market needs and contribution to security of supply** rather than on the installed generation capacity. The optimal interconnection level would depend, among others, on the ratio between installed generation capacity and peak demand, the flexibility of the generation park, the complementarity of demand curves and power generation parks in neighbouring countries and the price divergence levels.

At present, there is no explicit quantitative target for the interconnection of gas infrastructure, but the Security of Supply Regulation is indirectly stimulating investments in interconnectors. From an internal market perspective, grid investments and technical adaptations (harmonisation of gas quality, reverse flows) should mainly **focus on bottlenecks that still lead to structurally diverging wholesale prices** between EU countries or regions. The priority corridors and PCIs should support these investments.

9. EU funding programmes and instruments for energy infrastructure should be better aligned and be backed by an enabling and harmonised framework for cross-border investments

The wide range of **European financing programmes and instruments should be better aligned and linked under the Energy Union umbrella**. PCI projects should continue to be prioritised and funded, but this should be done according to a comprehensive EU-level energy infrastructure needs assessment. In addition, **procedures for access to funding should be simplified and streamlined** to allow investors to have a better overview and understanding of the different instruments and resulting in a more efficient use of resources. Investors also need an accessible and transparent overview of cross-border public sector investments at EU level and their status. Financing instruments need to be backed up by an **enabling and harmonised regulatory framework**, in particular for cross-border investments. Public and private capital should be mobilised in order to cover the investment needs for energy infrastructure in the EU. This should be done e.g. by lengthening time horizons of institutional investors, by developing specific financing instruments at EU level (e.g. bonds) and by providing a stable regulatory framework for investors.

10. EU funding for energy infrastructure should be raised and should target priority projects

Given the significant gap between the current EC funding and the investments needed in energy infrastructure, an increase of this budget should be considered and the CEF and EFSI funding should **give priority to the most crucial projects**. Grid projects should only be implemented when their macro-economic cost–benefit analysis presents a positive outcome. Projects should be financed by a **combination of grants, network tariffs and other funding sources**. 'Regular' grid investments should in general be funded through revenues form regulated grid tariffs while merchant projects can be funded through congestion revenues or bilateral contracts.

11. Power generation adequacy should be assessed at regional level and primarily be ensured by a favourable investment climate and well-functioning electricity markets and, as a last resort, by properly designed capacity remuneration mechanisms

Adequate investments in power generation capacity should first of all be facilitated by a **favourable and predictable investment climate** and by a proper **market functioning without price regulation**. As the current legal framework and market conditions are however not ensuring security of supply, CRMs are implemented in several MSs as a last resort instrument to ensure adequate generation. In order to streamline these national initiatives, any assessment of generation adequacy should be undertaken at regional level and MSs should opt for a design that does not distort the internal electricity market. CRMs should be: market-based, market-wide, open for participation of cross-border capacity, and harmonised at supranational or EU level. **A European framework regarding CRMs is necessary** to avoid market and competition distortions by ensuring that key features (such as technology neutrality and cross-border participation) are in place. At this stage, implementing an EU-wide CRM is not a feasible option due to the fact that national CRMs already exist and that there are national specificities in the energy and technology mix as well as diverging energy policies.

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ANNEX

Annex 1: Roadmap for the integration of IEM – Updated version (November 2015)

	Actions	Responsible party	Timetable
Infrastructure	Effective implementation of the 10 % electricity interconnection target	Commission, Member States, NRAs, TSOs	2015-20
	2nd list of Projects of Common Interest (PCI) – leading to Commission Delegated Act	Commission, Member States	2015
	Communication on the progress towards the completion of the list of the most vital energy infrastructures and on the necessary measures to reach the 15 % electricity interconnection target for 2030	Commission	2016
	Establish an Energy Infrastructure Forum	Commission, Member States	2015
Electricity	Initiative on market design and regional electricity markets, and coordination of capacities to ensure security of supply, boosting cross-border trade and facilitating integration of renewable energy	Commission	2015-2016
	Review of the Directive concerning measures to safeguard security of electricity supply Commission 2016	Commission	2016
Retail	New Deal for energy consumers: Empowering consumers, deploying Demand Side Response; using smart technology; linking wholesale and retail markets; phase-out of regulated prices; flanking measures to protect vulnerable customers	Commission, Member States	2015-2016
Gas	Revision of the Regulation on security of gas supply	Commission	2015-2016
Regulatory framework	Review of the Agency for the Cooperation of Energy Regulators (ACER) and the energy regulatory framework	Commission	2015-16
Renewables	Renewable Energy Package: including a new Renewable Energy Directive for 2030; best practices in	Commission	2015-2017

	Actions	Responsible party	Timetable
	renewable energy self-consumption and support schemes; bioenergy sustainability policy.		
Industrial competitiveness	Analysis of energy prices and costs (including taxes and subsidies)	Commission	2016 and every 2 years thereafter
	Enhanced trade policy to facilitate export of EU technologies	Commission	2015-2019
Cross cutting measures	Review of the Guidelines on State aid for environmental protection and energy	Commission	2017-2019
	Report on the European Energy Security Strategy; including a platform and roadmap for Euromed and strategies for LNG, energy storage, and the Southern gas corridor	Commission	2015-2016
	Data, analysis and intelligence for the Energy Union: initiative pooling and making easily accessible all relevant knowledge in the Commission and Member States	Commission	2016

Source: European Commission

Annex 2: Progress towards completing the IEM[127]

Area	Progress
General	• Unbundling rules and ten-year-network development plan have resulted in more efficient investment decisions making sure that most needed transmission lines are effectively being built. • Cooperative efforts level have resulted in both an umbrella organisation of energy regulators, Agency for the Cooperation of Energy Regulators (ACER), and an umbrella organisation of network operators, European networks of transmissions system operators (ENTSOs). • EU countries network codes are being established for both gas and electricity to facilitate cross-border cooperation. • 248 Projects of Common Interest (infrastructure, storage capacities) can benefit from more efficient permit granting procedures and financial support. • Implementation of the European Energy Plan for Recovery • Many 'missing links' in infrastructure have been completed. • Hubs and power exchanges facilitate trade and ensure economic dispatch resulting in a more efficient cross-border flow of energy. • New electricity infrastructure targets were proposed for 2030 (interconnection capacity should be 15 % of installed generation capacity). • Guidelines have been provided to avoid the implementation of uncoordinated and counter-effective national measures damaging the internal market (regional cooperation for security of supply issues).[128] • Consumers have more choice among energy suppliers
Electricity market	• Implementation of day-ahead market coupling results in the optimal flow of cross-border electricity volumes, smoothing out price differences between neighbouring countries as long as transmission capacity is available between these countries. In February 2014 nineteen MSs[129] had implemented day-ahead market coupling and in May 2014 Spain and Portugal joined as well. • Introduction of flow-based capacity allocation in February 2015 resulting in more efficient use of interconnection capacity. • Wholesale electricity prices have decreased by 35-45 % in 2008-2012, partly due to the increased competition in the electricity market. • Implementation of 1st Network Code on CACM in August 2015. • Introduction of Transparency Platform of ENTSO-E in January 2015 • Merger of CAO and CASC.EU resulting in collaboration between 20 TSOs from 17 countries and simplifying trading for market participants.
Gas market	• Adoption of network codes for gas in 2013-2016 • Adoption of the Security of Supply regulation resulting in more flexible pipelines (reverse flow), increased availability of storage capacity and the creation of better emergency plans. • Increased competition in gas market has resulted in more stable gas prices. • Increased regional cooperation in the gas market with the establishment of the PRISMA-platform in 2013 for the auctioning of interconnection capacity of 28 TSOs (covers about 70 % of Europe's gas consumption). • Missing links in Eastern EU gas grid were completed and LNG terminals built. • Cross-border pipelines are being used more efficiently.

Source: EC – COM(2014) 634 final

[127] EC COM(2014) 634 final
[128] EC(2013) 7243 final & 2014/C 200/01
[129] Belgium, Denmark, Estonia, Finland, France, Germany, Austria, UK, Latvia, Lithuania, Luxembourg, the Netherlands, Poland and Sweden and non-EU country Norway.

Annex 3: Case study on the electricity day-ahead wholesale market coupling in Central Western Europe and Central Eastern Europe

a. Executive Summary

Achievements

- Between 2006 and 2015 the day-ahead wholesale electricity markets of 19 European countries were coupled.
- In February 2014, the wholesale electricity Price Coupling of Regions (PCR) solution was implemented in North Western Europe (NWE). It incorporates the previously coupled Central West European region (CWE) with the Nordic, Baltic and UK power markets, along with the SwePol link between Sweden and Poland.
- In May 2015, Flow-Based Market Coupling (FBMC) was introduced in CWE, replacing the Available Transfer Capacity (ATC) method in place since 2010.
- Wholesale price convergence was increasing and reached a high level in 2012, but the progress has stopped in 2013 due to the evolution in the power generating mix (more congestion at borders, mainly resulting from strong development of wind and solar energy)
- Pilot projects have been launched to integrate intra-day and balancing electricity markets.

What still needs to be done

- Further integration of day-ahead wholesale electricity markets: the next step is joining other regions, including Central Eastern Europe (CEE) to the NWE region.
- There is a need for more transmission/interconnection capacity and flexibility.
- The commercially available interconnection capacity should be maximised and optimally used by an overall implementation across Europe of the Flow Based Allocation Market Coupling method.
- Need for stronger inter-TSO cooperation and governance at regional/EU level.
- National energy policies and market rules should be more harmonized and offer a favourable and stable framework for investors.
- Intra-day and balancing markets should also be integrated at supranational level.
- Cross-border procurement of ancillary services should be stimulated.

b. Description of the Cases

Given the similarities between these two case studies, we present the context as well as the conclusions and recommendations jointly.

Electricity day-ahead wholesale market coupling in Central Western Europe (CWE)

Since 2006 TSOs and power exchanges and national regulators in CWE are cooperating to couple their day-ahead electricity markets in order to enhance competition amongst power generators and lower the overall energy system cost by combining the national demand/supply curves. Day-ahead market coupling is fully completed in the CWE region and is now extended across a larger region in Europe, from Finland to Portugal. Lessons can be learned on how to facilitate and accelerate electricity market integration at EU level.

Electricity day-ahead wholesale market coupling in Central Eastern Europe (CEE)

In line with the experience on electricity market coupling in CWE, CEE countries are also collaborating to couple their day-ahead electricity markets. In 2011 Czech Republic, Slovak Republic and Hungary carried out the first regional experience on market coupling in CEE. In 2014 an extended set of CEE countries: Austria, Czech Republic, Germany, Hungary, Poland, Slovak republic and Slovenia, signed a Memorandum of Understanding (MoU) aiming to overcome market fragmentation and contribute to achieve the European single energy market.

c. Context

Box 5: Information on market coupling

What is market coupling? Market coupling refers to the integration of two or more electricity wholesale markets from different countries. It allows buyers and sellers on a power exchange to benefit automatically from available interconnection capacity, without having to conclude a separate contract for the corresponding capacity, hence the term "implicit auction". Progress has mainly been made in day-ahead coupling, while intraday market coupling is still in the implementation phase.

Day-ahead market coupling implies the coupling of day-ahead bids and offers of different power exchanges and applying a single algorithm to determine cross-border flows and day-ahead electricity prices. As all bids and offers are combined, the power plants with the lowest variable cost will be used to cover demand and electricity prices will be harmonised, until congestion takes place.[130] This means that there will be full price convergence in the coupled region when there is sufficient cross-border capacity available, while a price difference between countries will occur when there is congestion.

What do we need energy market coupling for? The purpose is to optimise the free movement of electricity between the markets in order to maximise the overall economic welfare at supranational level. Market coupling also allows to reinforce competition amongst power generators at supranational level, and is hence considered as an effective means to reduce the dominant market position of the national incumbents.

Well integrated markets make capacity and energy available between countries, connecting their energy mixes. This contributes primarily to three main objectives: higher security of supply, lower overall price level and higher efficiency of the energy system.

What is necessary to achieve market coupling?

- Spare **generation capacity available for the day ahead in at least one country**
- **Adequate transmission networks and a**vailable cross-border **interconnection capacity**
- Liberalised national wholesale **markets**

Interconnection capacity auctions and market coupling

There are two types of auctions to allocate cross border capacity to market participants: **explicit** and **implicit** auctions. Currently, cross border capacity in Europe is mainly allocated via explicit capacity auctions, where the transmission capacity of an interconnector is, via forward contracts, 'sold' to market parties separately and

[130] Amprion, APX, Belpex, Creos, Elia, EPEXpot, RTE, Tennet, Transnet BW (2014)

independently from where electricity is traded[131]. These separate processes can lead to inefficient utilisation of interconnectors (in particular if unused capacity is not sold back to the market), and to a suboptimal use of the power generation park from a macroeconomic perspective. With day-ahead market coupling, cross-border transmission capacity is implicitly allocated (auctioned) to market parties, which is in general more efficient than explicit auctioning. In this case market parties can directly benefit from electricity exchanges and do not have to separately acquire transmission capacity beforehand.[132]

Implicit capacity allocation the day before delivery allows to optimise the use of the available interconnection capacity. In this time span, there is accurate information on the spare transmission capacity which is available for commercial purposes. On the other hand, the day-ahead supply (merit order) and demand curves of the different national markets are available. This allows to determine what amount of electricity needs to be transmitted each hour amongst the different interconnected markets in order to maximise overall social welfare. As a result, the supply and demand curves of the concerned countries are merged, and cross border trade of electricity can be optimised without having to conclude separate contracts for interconnection capacity. An algorithm determines both electricity prices and transmission flows, ensuring that electricity flows from surplus areas (low price areas) to deficit areas (high price areas).[133]

Market coupling allows to optimize the use of both the generation park (lowest variable cost) and the grid infrastructure and cross-border interconnection capacity increasing the level of market integration.[134] It also optimizes the economic efficiency of the coupled markets by making sure electricity always flows in the most economically sound direction.[135] Wholesale prices converge unless there is congestion on the interconnectors. If one or more transmission capacity constraints do not allow to cover the demand by the least expensive generating units available, a price difference between the markets will still occur; this price difference between the markets represents the scarcity value of the transmission capacity in the region.[136]

Implicit allocation of interconnection capacity has considerable advantages over explicit auctions: Market participants are not exposed to the risk stemming from procuring the commodity separately from the capacity for its transmission. It avoids that a trader procures electricity, but has no transmission capacity for importing /exporting it, and vice versa. With FBMC, cross-border exchanges are carried out in the right direction of the price differential at all times, supporting the most economical dispatch and maximising social welfare.

Several aspects determine the success ratio and benefits of electricity markets' integration: generation capacity and mix (complementarity), adequacy of transmission and distribution infrastructure, cross-border interconnections, market regulation and common/diverging policies, technical codes and market rules. These issues will be described and assessed in the following section to facilitate the assessment of the case studies on market coupling.

Progress / Implementation

Between 2006 and 2015 the day-ahead markets of 19 European countries were coupled. The 4th of February 2014, marked the date of the first implementation of the Price

[131] Tennet (2010)
[132] BELPEX website: https://www.belpex.be/services/market-coupling/about-market-coupling/
[133] Tennet (2010)
[134] EPEX SPOT (2015) and Pellini - Surrey Energy Economics Centre (2011)
[135] EPEX SPOT (2015) and Pellini - Surrey Energy Economics Centre (2011)
[136] Amprion, APX, Belpex, Creos, Elia, EPEXpot, RTE, Tennet, Transnet BW (2013)

Coupling of Regions (PCR) solution in North Western Europe (NWE). Completion of this project is a major step towards an integrated European power market. It was the first regional market initiative to use the pan-European PCR solution for the calculation of prices and flows - the starting point for other regions to join. The project incorporates the previously coupled CWE with the Nordic, Baltic and UK power markets, along with the SwePol link between Sweden and Poland. In May 2015, **Flow-Based Market Coupling** (FBMC) was introduced in the CWE region, replacing the **Available Transfer Capacity** (ATC) method which was in place since the end of 2010. The next step is coupling the different regions, including CEE to the NWE region.

Policy context[137]

In order to harmonise and liberalise the national electricity and gas markets in view of the creation of an EU wide internal energy market, three legislative packages were adopted. The recommended market design, which is referred to as the European Target Electricity Market Model, includes a set of proposals and network codes based on two broad principles: (1) well-functioning regional energy markets and (2) market coupling between the different regional markets.[138] The Target Model aims to integrate national electricity markets by coupling them via the interconnectors so that the generating units with the lowest variable cost are used and the electricity transmission capacity is efficiently allocated across the EU by a single auctioning platform, Euphemia.[139] In 2015, the Regulation on Capacity Allocation and Congestion Management (CACM) [140] was published. It is the first of the ten EUs electricity network codes and guidelines developed in accordance with the EU Third Energy Package. It provides the methods for the calculation and allocation of day-ahead and intraday interconnection capacity, and considers FBMC as the target model.[141]

In combination with the network codes, coordinated regional market-coupling initiatives are essential to achieving an internal energy market.[142] In 2012 ACER and ENTSO-E started a pilot project on the assessment and review of the efficiency of the bidding zone configuration in some parts of Europe. This project was launched due to difficulties in the completion of the Electricity Target Model; it was assumed that progress was hampered by the bidding zone configuration in Central Europe. The pilot project (as described in the 2014 report[143]) performed the assessment and review for the regions of CWE (Belgium, France, Germany, Luxembourg, the Netherlands), Denmark-West, CEE (Austria, Czech Republic, Germany, Hungary, Poland, Slovakia, Slovenia), as well as Switzerland and Italy as they are part of the highly meshed network in Central Europe. The report concluded that the existing bidding zone configuration in Central Europe has indeed some negative side-effects and ENTSO-E will carry out a full review process by comparing alternative bidding zones for Central Europe.

[137] The overall policy context is described in the main report; in this section we focus on specific aspects related to market coupling.
[138] KU Leuven (2015b)
[139] Newbery et al (2015)
[140] Commission Regulation (EU) 2015/1222
[141] These guidelines determine the roles of the main actors in the Day-Ahead / Intraday electricity market: Transmission System Operator (TSO); Nominated Electricity Market Operator (NEMO); Market Coupling Operator (MCO); Coordinated Capacity Calculator; and Scheduled Exchange Calculator. Member States should designate a “Nominated electricity market operator” (NEMO), which must be independent from market participants. NEMO is responsible for the local and cross-border operation of markets and must establish one or more Market Coupling Operators (MCOs). If the NEMO does not succeed in this, ENTSO-E will appoint a single MCO.
[142] ENTSO-E (2014)
[143] ACER (2014c)

Governance

The implementation of market coupling is mainly based on voluntary agreements between the different TSOs and power exchanges that participate in this process on an equal basis. National regulators and authorities are also involved, but a national authority can in principle not impose its views in such a multinational initiative. The European Commission and the Agency for the Cooperation of Energy Regulators (ACER) also support these initiatives[144], but they have limited power to intervene if stakeholders do not agree on the choice of a common solution or instrument, due to conflicting individual interests. Lessons should be learned from the different current experiences in order to improve the governance procedure.

d. Case study: Electricity day-ahead wholesale market coupling in Central Western Europe

Key stakeholders and figures for CWE

The table below provides an overview of the key stakeholders (TSOs, NRAs and electricity exchanges) in CWE.

Table 8: Overview of key stakeholders in CWE countries

MS	TSO	NRA	Electricity exchanges
BE	Elia System Operator	Commission pour la Régulation de l'Electricité et du Gaz (CREG)	APX Group (Belpex)[145]
FR	RTE	Commission de Régulation de l'Energie (CRE)	EPEX Spot
DE	TransnetBW; TenneT TSO; Amprion	Federal Network Agency for Electricity, Gas, Telecommunications, Posts and Railway	EPEX Spot
LU	Creos Luxembourg	Institut Luxembourgeois de Régulation	EPEX Spot
NL	TenneT TSO	Dutch Office of Energy Regulation	APX Group

Amprion et al. (2013) gives an overview of the roles of the main stakeholders in the FBMC solution. The figure below provides a diagram of the FBMC governance structure in CWE.

[144] EPEX SPOT (2015)
[145] Since October 2015 APX Group and EPEX SPOT have integrated their businesses

Figure 14: Governance structure for FBMC

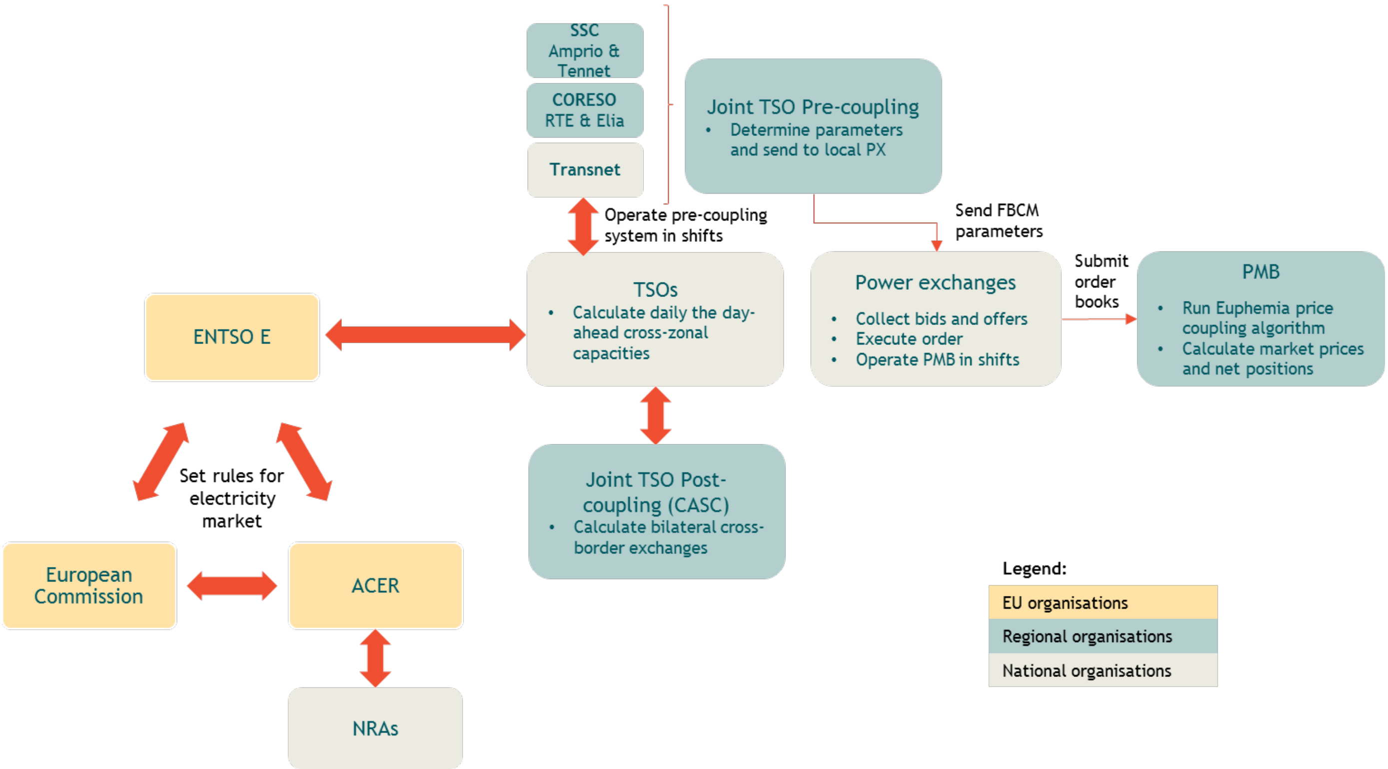


Table 9 provides an overview of key figures on cross-border electricity trade for the different countries in the CWE region.

Table 9: Overview of key figures for CWE countries

MS	Import (TWh, 2014)	Export (TWh, 2014)	Interconnection (2014)[146]	Net generation capacity (GW, end 2014)	Max hourly load (GW, January 2014)[147]
BE	21.7	4.2	17 %	20.1	13.0
FR	7.8	73.6	10 %	128.4	79.3
DE	38.9	74.6	10 %	190.1	78.6
LU	7.0	2.1	245 %	2.0	0.8
NL	32.9	17.9	17 %	32.5	17.8

Source: ENTSO-E (2015), EP (2015), Entso-E website

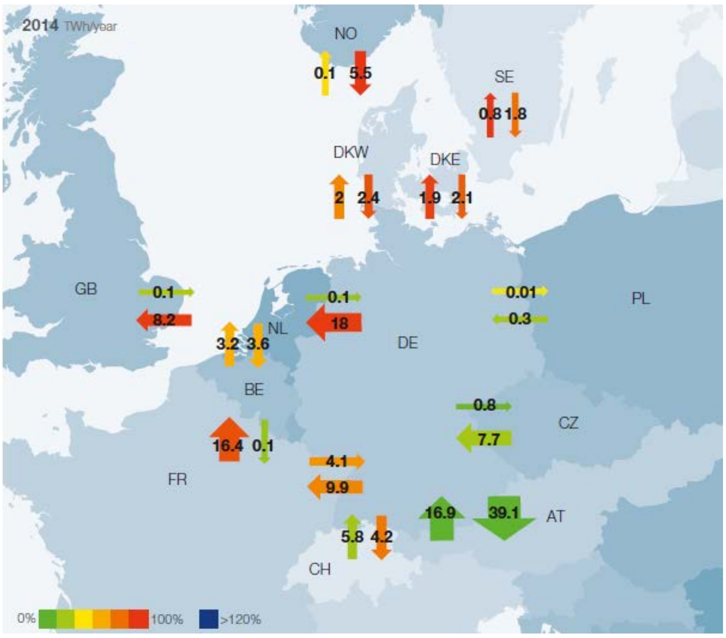
In the figure below an overview is given of the aggregated scheduled commercial flows in Europe in 2014.[148] It shows (see colour of arrows) that the interconnection capacity was in the CWE region in 2014 more utilized than in other European regions.

[146] Interconnection capacity as percentage of installed generation capacity in 2014. EP (2015) Report on achieving the 10% electricity interconnection target – making Europe's electricity grid fit for 2020 (2015/2108(INI))

[147] Maximum hourly load in the 3rd Wednesday of January 2014

[148] The colour of this arrow shows the percentage of the capacity that was made available to the market that was used

Table 10: Cross-border scheduled commercial day-ahead electricity flows in 2014[149]



Source: Tennet, 2014

Objectives and implementation of market coupling in CWE

The objective of the day-ahead market coupling in CWE was to increase the overall social welfare and competitiveness by optimising the use of available cross-border transmission capacity and enhancing cross-border trading. Between November 2006 and November 2010, French, Belgian and Dutch power exchanges, TSOs and regulators have successfully realised the Trilateral Market Coupling (TLC). The Memorandum of Understanding (MoU) signed by 5 CWE countries (FR, BE, NL, DE, LU) in 2007[150] set the following priorities for the CWE region:

- Harmonization and improvement of long-term explicit auction rules
- Implementation of a day-ahead Flow Based market coupling
- Implementation of cross-border intraday trade
- Optimal use of the cross-border capacities
- Transparency
- Security of Supply

The next step of market harmonization was achieved on 9 November 2010, with the launch of market coupling in Central West Europe (covering Benelux, France and Germany), known as CWE. In parallel, CWE has been volume coupled since November 2010 with the Nordic region via the Interim Tight Volume Coupling ITVC.[151] This market coupling was extended to the Multi-Regional Coupling covering 19 countries in 2015. In May 2015, the calculation of cross-border capacities in CWE switched to Flow-Based Market Coupling

[149] The colour of the arrow represents the percentage of the total interconnection capacity that was made available to the market that was used.

[150] Memorandum of Understanding, 2007. Recovered from http://www.tennet.eu/nl/fileadmin/pdf/news-archive/Intentieverklaring_tcm43-13816.pdf

[151] Volume coupling implies that the volume traded between countries is determined before individual power exchanges calculate their prices. Tight volume coupling means that the trading volume is calculated using all relevant information such as order books and ATCs

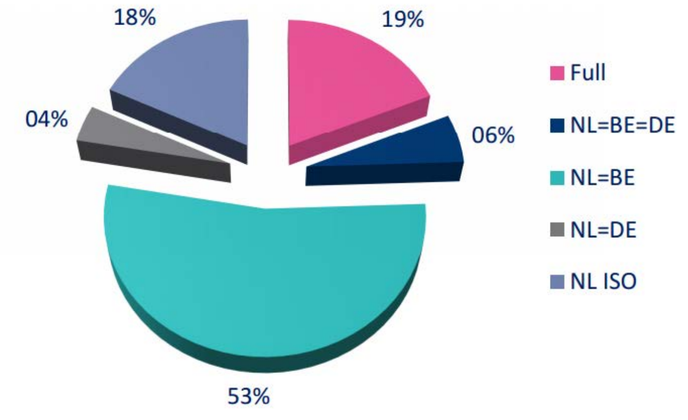
(FBMC), replacing the Available Transfer Capacity (ATC) method.[152] Given the CWE region's role as pioneer in the market coupling, this case study is highly relevant for the EU and will provide valuable lessons on how to facilitate and accelerate electricity market integration at EU level.

Key findings, challenges and bottlenecks in CWE

Notwithstanding the lack of an adequate and efficient regulatory oversight of supranational (regional) market initiatives, the CWE day-ahead market coupling has been successfully implemented, thanks to the commitment of the concerned TSOs and power exchanges, and the full support of market parties and national authorities. Suppliers and consumers across the region can benefit of enhanced competition amongst generators and more converging and on average lower wholesale prices: the increase of social welfare as a result of CWE market coupling is estimated at EUR 42 million annually.[153] The Pentalateral Forum stated however in June 2015 that the FBMC methodology can still be further improved to fully reach an integrated, secure and sustainable electricity market. Furthermore, it mentioned that regional initiatives are needed including a stable political framework and governance rules, as well as a transparent and compatible working method. [154]

An assessment carried out by APX[155] shows the price convergence between the coupled Day-Ahead markets in CWE in 2014 (see figure below). 18.6 % of the hourly prices were in 2014 convergent in the full CWE region (versus 14.7 % in 2013). The price convergence was in previous years substantially higher (prices converged during 66 % of the time in 2011 and 46 % in 2012), suggesting that market coupling has failed to overcome national supply/demand factors.[156] The low full price convergence in 2013 and 2014 is mainly due to increasing congestion at the borders as a consequence of the unavailability of nuclear plants in Belgium and the massive development of intermittent power generation in Germany. The ongoing investment projects of the grid operators will lead to higher interconnection capacities as of 2018, with positive effects for the market coupling and price convergence. So while market coupling does have a price converging effect, prices may still diverge due to grid congestion as a consequence of additional RES deployment.

Figure 15: CWE Hourly Price Convergence in 2014



Source: APX (2014)

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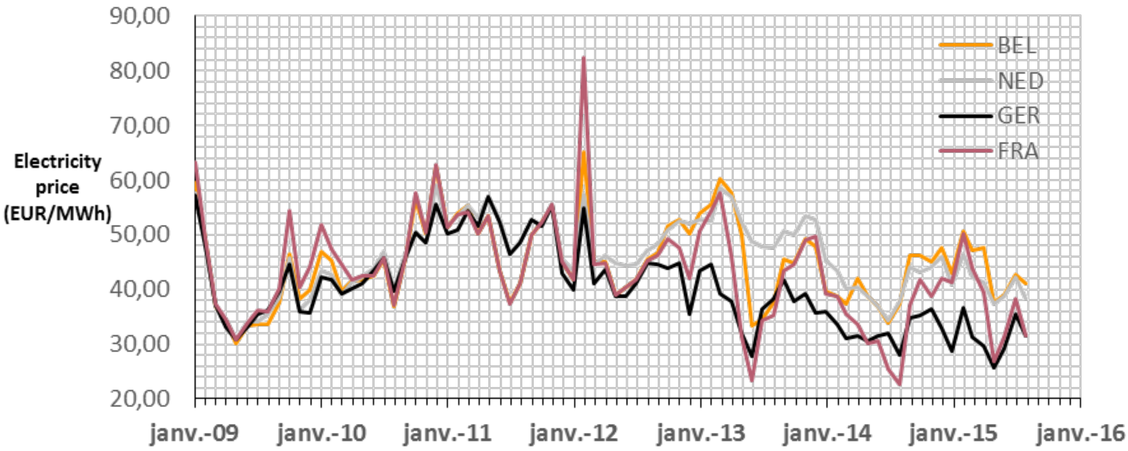
[152] KU Leuven (2015b)
[153] Tennet (2010)
[154] Pentalateral Energy Forum (2015)
[155] APX (2014)
[156] http://blogs.platts.com/2014/02/27/single-eu/

Despite the fact that the price convergence has in general substantially increased in the CWE region since the introduction of market coupling, large price differences remain between the countries (see figure below). The price differences can be explained by both limited cross-border transmission capacity and the specific characteristics of the generation stock across the countries. Germany, for instance, has a high share of intermittent renewables which result in very low (or even negative) wholesale prices during periods (e.g. sunny weekends) of low demand and high supply from wind and solar energy sources. At that moment the interconnection capacity is often not high enough to export this oversupply to neighbouring countries and prices are hence diverging.

Figure 16: Monthly Average of hourly Day-ahead wholesale prices in CWE countries



Source: Sia Partners, 2016

An urgent need exists to increase the commercially available interconnection capacity, both by reducing the security margin reserved by TSOs for operational purposes and by investments in new interconnections or reinforcements of existing lines. If all planned investments would not be sufficient to have a properly functioning supranational market and to avoid structural congestion, additional initiatives should be assessed, including more flexibility at supply and demand side (demand response), energy storage and other technical solutions (e.g. power to gas).

e. Case Study: Electricity market coupling in Central Eastern Europe

Key stakeholders and figures for CEE

The following table provides an overview of the key stakeholders and some relevant figures for the countries that are part of the CEE region. The roles of these stakeholders in market coupling are similar to the roles of stakeholders in the CWE region, as was described earlier.

Table 11: Overview of key stakeholders for CEE countries

MS	TSO	NRAs	Electricity exchanges
AT	Austrian Power Grid AG (APG) TIWAG-Netz AG VKW-Netz AG	Energie-Control Austria(E-Control)	European Energy Exchange (EEX)

MS	TSO	NRAs	Electricity exchanges
CZ	ČEPS a.s. (CEPS)	Energetický Regulační Úřad(ERÚ) - Energy Regulatory Office (ERO)	Power Exchange Central Europe (PXE) OTE
DE	TenneT TSO GmbH Amprion GmbH 50 Hertz Transmission GmbH TransnetBW GmbH	Bundesnetzagentur - BNetzA	European Energy Exchange (EEX)
HU	Hungarian Electricity System Operator Ltd. (MAVIR)	Magyar Energia Hivatal (MEH)/ Hungarian Energy Office (HEO)	Hungarian Power Exchange (HUPX)
PL	Polskie Sieci Elektroenergetyczne S.A. (PSE)	Urząd Regulacji Energetyki (URE)/ The Energy Regulatory Office of Poland(ERO)	Polish Power Exchange (Towarowa Giełda Energii S.A - TGE)
SI	Elektro-Slovenija, d.o.o. (ELES)	Javna Agencija Republike Slovenije za energijo / Energy Agency of the Republic of Slovenia (AGEN-RS)	Borzen (*)
SK	Slovenská elektrizačná prenosová sústava, a.s. (SEPS)	Úrad pre reguláciu sieťových odvetví (URSO) / Regulatory Office for Network Industries (RONI)	OKTE

Table 12: Overview of key figures for CEE countries.

MS	Import (TWh, 2014)	Export (TWh, 2014)	Interconnection (2014)[157]	Net generation capacity (GW, end 2014)	Max hourly load (GW, January 2014)[158]
AT	28	18.8	29 %	24.2	9.6
CZ	11.8	28.1	17 %	20.7	9.3
DE	38.9	74.6	10 %	190.1	78.6
HU	19	5.7	29 %	8.5	5.7
PL	13.5	11.3	2 %	36.0	22.2
SI	7.2	9.6	65 %	3.5	2.0
SK	12.9	11.8	61 %	8.1	3.9

Sources: ENTSO-E (2015), EP (2015), Entso-E website

[157] Interconnection capacity as percentage of installed generation capacity in 2014. EP (2015) Report on achieving the 10% electricity interconnection target – making Europe's electricity grid fit for 2020 (2015/2108(INI))

[158] Maximum hourly load in the 3rd Wednesday of January 2014

Objectives and implementation of market coupling in CEE

The key electricity players in Austria, Czech Republic, Germany, Hungary, Poland, Slovakia and Slovenia have signed, together with ACER, a Memorandum of Understanding (MoU). The MoU is aimed to couple the countries' markets by using a flow-based method for calculating the capacities on the cross-border electricity interconnectors and by implicitly allocating these capacities based on the Price Coupling of Regions solution. This agreement between TSOs, PXs and NRAs is taking place in the frame of the Regional Initiatives (RI) process coordinated by ACER. The RIs aim at the early implementation of the Network Codes - in this case the Capacity Allocation and Congestion Management Network Code – before they enter into force and become legally binding. This initiative contributes to the development of the single EU energy market by creating larger price zones, which foster competition and lead to more price convergence and a better choice of services and products for consumers.

The project consists of both flow-based capacity calculation and implicit capacity allocation (based on the PCR solution), that are to be implemented in one single step. This project is in line with the European target model for day-ahead markets and ensures compatibility with other regional and cross-regional price coupling projects.

The MoU expresses the intention of the concerned TSOs and PXs to continue and intensify their cooperation in the CEE region. In addition to existing structures (e.g. among TSOs on capacity calculation), a common project structure and a detailed project plan are now to be established. This will be supported and monitored by the NRAs and ACER. The new project will enable coordination of the CEE region with other European regions in the electricity market to take common, coordinated steps to facilitate the process leading to the creation of the European Internal Energy Market (IEM).

The CEE countries have recently approved a road map[159] to implement flow-based electricity market coupling in the region by the end of 2018. The project aims to optimise the use of regional grids to allow electricity flow to the most expensive price region, thereby reducing price differences between coupled countries. The grid as a whole will be considered when allocating cross-border capacity, rather than each transmission line being considered separately. Project parties are currently in the process of signing a binding framework project agreement and a high-level market design and roadmap have been discussed and agreed upon with national regulatory authorities.

As shown in the CWE case study, the flow-based market coupling system is already active in central Western Europe and includes France, Germany, the Benelux countries and Austria. The extension of flow-based market coupling to the CEE is in line with the European Commission's draft guidelines on capacity allocation and congestion management at transmission lines. The CEE flow-based project would involve Germany, Poland, Czech Republic, Slovakia, Austria, Hungary and Slovenia.

Key findings, challenges and bottlenecks in CEE

In 2011 Czech Republic, Slovak Republic and Hungary coupled their markets on the basis of the Single Price Market Coupling for day-ahead market with implicit allocation of cross-border capacities. This market coupling experience used the ATC method, instead of the flow-based market coupling, which offers in general a higher overall social welfare compared to the ATC methodology as a result of a more efficient use of cross-border capacity (for background information see section 3.1). The price convergence between

[159] http://www.icis.com/resources/news/2015/10/26/9936332/road-map-for-cee-flow-based-market-coupling-agreed/

Slovakia, Czech Republic, and Hungary increased from 11 % to 82 % after effective market coupling in September 2012 but in 2014 the spread was still constant at around 5 EUR/MWh (see graph below).

Figure 17: Weekly baseload price premiums or discounts to the German market

Source: Quarterly report on European electricity markets 2015 Q1

The figure below shows the co-existence of price divergences and low adverse power flow ratios between neighbouring markets. The graph also shows that adverse power flows between Hungary and Slovakia became almost negligible after their markets coupling in 2012, even though there is still price divergence (less significant than before). The price convergence between the Czech Republic, Slovakia and Hungary was in 2013 about 70 %, and between Czech Republic and Slovakia only, this ratio was in 2013 almost 98 %. Compared with 2012, price convergence in the three markets declined by 8 %. A marked decrease in price convergence is visible mainly in the second half of 2013.

Figure 18: Monthly ratios of convergent hourly price & monthly adverse power flow ratios between DE and NL and between HU and SK (in %).

Source: EC (2015), EU Energy Markets in 2014

The MoU signed in 2014[160] by Austria, Czech Republic, Germany, Hungary, Poland, Slovak Republic and Slovenia aims to go beyond the previous coupling experience of Czech Republic, Slovak Republic and Hungary by implementing the FBMC method for the whole CEE region.

The study on the current situation of the CEE region for achieving the FBMC implementation (and subsequent market coupling) has shown that the main obstacles to be overcome are those related to infrastructure, market regulation and instrument design.

Infrastructure

CEE countries recognised in the MoU agreement that cross-border grid capacities in the region are, in many cases, not sufficient to allow cross border exchanges. Some countries keep limiting the cross-border capacity they make available for trade. Poland e.g. limits its cross-border capacity in order to avoid that power from wind farms in north Germany flows via the Polish grid to south Germany and Austria. Austria has limited its commercially available interconnection capacity with Hungary several times in 2015, and also the capacity between Slovakia and Hungary has been cut.

CEE countries have meanwhile taken several initiatives to address this issue. For instance, Czech Republic is planning measures to mitigate the risk of an electricity blackout, which is due to the significant increase of electricity generated by wind farms in northern Germany, combined with insufficient intra-German transmission capacities and the closure of 8,000 MW of nuclear plants in northern and southern Germany. CEE transmission networks must hence be urgently reinforced; in this context the Czech TSO CEPS has prepared a 10-year investment plan, modelled to ensure the development and modernisation of Czech electricity infrastructure whilst contributing to the integration with neighbouring electricity markets.

The integration of markets in the CEE region (and the implementation of the target model) is being hindered by loop flows, which affect the Czech and Polish transmission systems. The increased occurrence of loop flows is mainly related to the size and topology of the German-Austrian trading zone and to the massive wind power development in northern Germany.

In Poland, the existing cross-border lines, with a total capacity of 5 GW, are currently largely not available for trade due to restrictions set by the Polish TSO for coping with unplanned energy inflows from Germany. As the large wind energy production in northern Germany cannot be transmitted within Germany to the consumption zones in the south, it flows into the networks of neighbouring countries creating so called ‘loop flows’. As a consequence, the Polish TSO has closed most of its interconnection capacity with Germany for trade.

In order to limit the impact of unplanned flows to the Czech transmission system, a phase shifting transformer (PST) will be built in 2016-2017 at its interconnection with 50 Hertz (Germany). This transformer will support more efficient control of flows in the interconnected transmissions systems in the CEE region, thereby significantly boosting security of supply; the operation of the transformer will be coordinated with the neighbouring TSOs. This measure is also expected to help optimise the use of cross-border transmission capacities.

Hungary is planning to increase its cross-border transmission capacities, Germany is extending and reinforcing its electricity grid in order to facilitate the integration of

[160] Agency for the Cooperation of Energy Regulators, TSOs, PXs and NRAs of the CEE region (2014)

renewable energy and Poland and Slovakia are also planning the modernization and development of their transmission network. See Annex I for further details.

Market regulation

While market coupling theoretically increases market efficiency, issues such as market design or other regulatory interventions have a significant impact on the actual impacts of market coupling. Therefore, it is important to align the different national regulatory frameworks[161].

Diverging national regulations can hamper the integration of the electricity markets and lead to suboptimal economic outcomes and/or competition distortion. In order to maximise the benefits of market coupling and the creation of a single electricity wholesale market in the CEE region, national regulation needs to converge. Additionally, generation, trade and supply activities must be liberalised and open for new entrants on an equal basis in the different countries and entry barriers must be removed. The analysis of the situation in the CEE region shows that fair competition is still an issue in several CEE countries. For instance, in Slovenia, most players in the electricity market are still directly or indirectly controlled by the state authorities. The Czech Republic has had issues in the past regarding market abuse. In 2013, CEZ and the EC reached an agreement in an investigation of alleged market abuse by CEZ, whereby CEZ had to sell one of its coal fired power plant in the Czech Republic. After this sales transaction in March 2013, CEZ still remains the dominant electricity generator in the Czech Republic. The settlement agreement between CEZ and the EC represents a major step towards ending the EC's investigation into the supposed abuse by CEZ of its dominant market position through reserving electricity capacity in the Czech transmission network to prevent competitors from entering the market. See Annex I for further details.

Instrument design

The market coupling instrument needs to properly integrate heterogeneous systems securing electricity supply while covering the electricity demand at least overall cost and enabling price convergence. At the same time, its design must permit further integration of other countries/regions, as the final aim is to achieve the single European energy market. The proposed harmonisation approach, which has been agreed with PXs, TSOs and energy regulators, is a prudent one, setting only the minimum degree of harmonisation necessary to achieve progress, and leaving scope for maintaining existing rules and respecting regional or national specificities wherever possible.

As aforementioned, Czech Republic, Slovak Republic and Hungary coupled their markets in 2011 using the ATC method. The intention of the MoU signed in 2014 is to include more CEE countries and upgrade the market coupling method system from ATC to FBMC. As stated in a study by the KU Leuven Energy institute, flow-based market coupling leads to a more efficient use of generation and transmission resources. While under ATC, TSOs determine capacity values based on forecasts and historical data, the FB mechanism allows TSOs to also take into account the impact that trade will have in terms of physical flows on the network. Subsequently, more capacity is in general offered to the market under FB market coupling, resulting in an overall welfare gain and increased price convergence.

However, the flow-based solution is less transparent than the ATC mechanism. The necessary input data TSOs have to provide is complex and influences the market outcome.

[161] EC (2014d) – COM(2014) 634

Also, the capacity calculation process is less straight-forward and flow-based market coupling occasionally leads to unpredictable auctions outcomes. This may be confusing for market parties. Additionally, flow-based market coupling does not solve the problem of congestion management inside bidding zones.

f. Economic benefits of CEE and CWE market coupling

As mentioned above, the main objective of market coupling is the increase of social welfare. In previous sections, it is mentioned that the PCR solution has been implemented in the NWE region in 2014, but there is no ex-post analysis of the impact of this implementation yet.

Nevertheless, based on simulations published by ACER (2012) and EP (2013), the CWE region alone has achieved gains from trade worth more than EUR 250 million per year in comparison to isolated national markets[162]. However, major potential trade gains are still left unrealized, e.g. between Italy and France (about EUR 19 million per year), Germany and Sweden (about EUR 10.5 million per year) and the Netherlands and Norway (about EUR 12 million per year).

The switch from ATC MC to FBMC has provided an increase in social welfare for CWE of around 100M Euro on an annual basis.[163] Further, the switch has improved the reliability, stability and robustness of the system, and has led to a significant decrease of congested hours and a better price convergence between different bidding zones.[164] The study[165] also showed some increases in price volatility and a limited correlation with prices under ATC Market Coupling, especially in the smaller markets.
According to another study, the potential benefits at EU level of coupling interconnectors to increase the efficiency of trading day-ahead, intra-day and sharing balancing services efficiently across borders could be as high as EUR 3.3 billion/year in the short run, more than 100 % of the current gains from trade.[166] About one-third of this total comes from day-ahead coupling and another third from shared balancing services.

There are few studies quantifying the benefits of market coupling (See table 13).

Table 13: Quantitative benefits of market coupling

Author (year)	Benefits
De Jong, Hakvoort and Sharma (2007)	Simulated a simplified model of FR, DE, NL and BE to estimate the welfare effects that flow-based market coupling (FBMC) would have on those countries, which they found to be about EUR 200m per year.
Meeus (2011)	Studied the impact of the 600 MW Kontek HVDC cable from East Denmark to Germany, first from the period of no coupling, through two implementations of approximate coupling, ending with one-way market coupling, still imperfect as it resulted in flows against the price differential (FAPD) of about 5 %. The estimated welfare gain was about EUR 10m per year or about EUR 17,000/MW/yr.
SEM Committee (2011)	Estimated the social costs of not using the two interconnectors between GB and the Single Electricity Market (SEM) of the island of Ireland (which had a combined capacity of 950/910MW imports, 580MW exports) for 2010. The estimates included price responses and a dead band (with no trade) of EUR 5/MWh to allow for various losses and

162 See ACER (2012: pp. 66) for a more detailed description.
163 Amprion, APX, Belpex, Creos, Elia, EPEXpot, RTE, Tennet, Transnet BW (2013) and ACM, Bundesnetzagentur, CREG, CRE, E-Control (2015)
164 ACM, Bundesnetzagentur, CREG, CRE, E-Control (2015)
165 Amprion, APX, Belpex, Creos, Elia, EPEXpot, RTE, Tennet, Transnet BW (2013)
166 Newbery et al (2015)

Author (year)	Benefits
	transmission access charges. The social welfare gains from coupling were estimated at EUR 30 million per year for an average import capacity of 930 MW or EUR 32,000/MW/yr, more than twice that of the Kontek cable.
Böckers et al (2013)	Measured the extent to which market integration can share peak demand more efficiently, and found that about half of neighbouring countries peak demands are non-coincident and so the capacity needed to supply them jointly could be reduced. They report studies of price convergence that shows in some pair-wise comparisons that considerable convergence preceded coupling. They roughly estimated gains from harmonizing PV support schemes and found large benefits (more than EUR 700 million per year just be reallocating support from Germany to Spain).
Pellini's (2014)	Used a power simulation model of Italy with an econometric estimates of price formation in neighbouring markets (FR, CH, AT, SL and GR) to examine the benefits of coupling the Italian market for 2012. She found that in the reference scenario for 2012 and allowing for continued market power, market coupling increased net welfare (the arithmetic sum of changes in producer, consumer and transmission surpluses) by 33 million EUR/year (million EUR /yr), but if coupling credibly increased competition on the northern border, the net welfare gain rose to 396 million EUR /yr, although this is still 278 million EUR / yr below that theoretically achievable under perfect competition. In the high scenario in which the economy recovered relative to 2010 and oil prices were higher, the welfare gain from coupling increased to 132 million EUR/yr without more competition, and to 742 MEUR /yr with more competition, although still 326 million EUR / yr short of perfect competition. These simulation results show that the gains from integration can be highly sensitive to relative fuel prices (which clearly can affect the gains from trade), the level of demand in the importing country (Italy) particularly in the presence of market power and hence rapidly rising prices as demand tightens, and of course the impact that coupling has on market power.
Cambridge University – Energy Policy Working Group (2015)	Improving the existing day-ahead arbitrage trade on interconnectors through coupling is worth 10-20% of the potential gains from trade, which at EUR 10/MWh is 10-20% of EUR 3.15 billion/yr or EUR 315-630 million/yr, or less than half the figure of 1 % of the value of wholesale demand.

Source: Cambridge University – Energy Policy Working Group (2015)

The Cambridge University paper[167] mentions that simulation studies of FBMC may underestimate the benefits because 1) the models lack sufficient richness to identify all of the transmission difficulties that FBMC may relieve, and 2) they are calibrated to older generation portfolios with less renewable generation, and which therefore congest transmission systems less than now.

g. Other benefits of CEE and CWE market coupling

Enhanced competition

Market coupling leads to enhanced competition in the electricity sector. By enlarging the market geographically, all electricity generators that are active in the coupled market are competing amongst each other which increases competition. While certain electricity producers might have had a dominant position at the national level in the past, their market share and market power is in the enlarged market much lower. Market coupling is hence an efficient instrument to mitigate market concentration and to enhance competition.

167 Newbery et al (2015)

Improved competitiveness and more converging prices

Market coupling will result in lower average prices, as the electricity will be produced by generators with the lowest marginal production costs. Also, as a result of market coupling, prices will convergence. The clearing price and also the overall system cost in the coupled market will be lower than the weighted average price and cost in separated markets, which means that in general both a consumer and a producer surplus will be created by market coupling. Lower wholesale electricity prices result in increased competiveness w.r.t. other countries. Also, as a result of market coupling, price convergence will increase. This is mostly beneficial for industrial end-consumers, as this results in decreased competition distortion within the coupled region. Price convergence is seen as an important indicator of the success of market coupling.

Improved security of supply

With market coupling all available interconnection and generation capacity in the interconnected area can be used to cover the overall electricity demand, which results in increased security of supply. In case that no sufficient domestic generation capacity is available in one country, generation capacity from another country can be used to cover its demand. If wholesale prices are in the interconnected market still diverging due to (structural) congestion at the border, the price differentials between countries should in principle trigger investments in additional interconnection capacity, which will contribute to enhanced security of supply in the medium/long term.

Support to RES development

Thanks to the mechanism of implicit allocation of all available interconnection capacity, electrical energy, including from renewable energy sources can be more easily exchanged among countries. Electricity produced by wind and solar installations has for legal and economic (low variable cost) reasons, priority in the combined merit order of the interconnected market, and will hence be the privileged source to cover the demand in the whole region. The integration of electricity systems and markets also allows to spread local production surpluses from renewable sources across a larger region, and reduces the need to curtail their injection. It is clear that day-ahead market coupling has positive effects for the development of renewable energy sources; the organisation of integrated intraday and balancing markets at supranational level is however undoubtedly another important instrument that can offer substantial additional benefits, in particular for the development of intermittent renewables.

h. Key Lessons & recommendations

The economic benefits of market coupling should be evaluated and maximised at supranational level

The social welfare of cross-border investments and trade should be evaluated and maximised at supranational level: market coupling offers benefits to consumers in the importing country (lower prices) while consumers in the exporting country pay in principle a higher price. The economic impact of market coupling on power generators is also positive or negative depending on their location. Market coupling should however not be limited or rendered impossible by short time interests of individual market parties or countries, as it offers substantial global macro-economic benefits: it leads to overall lower price levels (positive for competitiveness of EU economy), it enhances competition in the electricity sector and mitigates the dominant market position of the former incumbents, and it contributes to security of supply. The day-ahead market coupling in CWE can in

general be considered as a success and an example for other European regions. Suppliers and consumers across the region can benefit of enhanced competition amongst generators and of more converging and on average lower wholesale prices. However, price convergence has dropped in some areas due to increased grid congestion, as a result of the high share of renewable electricity generation.

Some preliminary conditions should be met for effective market coupling and price convergence

Market coupling leads to more competition and (more) converging prices; in order to have a successful outcome three conditions are essential:

- The Member States have to be committed to ensuring the development of liberalised and competitive markets;
- The trading mechanisms used in Member States have to be compatible across borders. If one Member State uses a business to business model and the other is part of a regional exchange, effective market coupling is impossible;
- Sufficient capacity of the transmission networks across borders, but also within Member States, must be available.

The effectiveness of market coupling further depends on the energy policies and the demand curves and power generation mix in the different countries (type, complementarity, etc.).

Market coupling requires a stronger governance at supranational/EU level

The **governance process** is very critical: we notice that the decisional and operational processes are complex and very time consuming due to the fact that national TSOs, regulators and power exchanges are responsible for their national electricity system and are not always motivated to take supranational interests into account. The ongoing elaboration of EU wide network codes will facilitate the market integration process, but the role of ACER could be legally reinforced in order to stimulate and accelerate this process. Stronger and more structured inter-TSO cooperation as well as a further integration of 'national' power exchanges would also contribute to a more rapid and efficient market integration.

There is a need for a balance between the current voluntary approach and a more mandatory approach. At the moment, there is a cooperation between TSOs and PXs, without hierarchy or arbitrage. In this situation, the process to agree on a common solution is often lengthy, difficult and complex given the individual and sometimes conflicting interests (e.g. choosing one methodology over another might lead to winners and losers). In this context, different stakeholders argue for stronger **governance at the EU level**. For example, EPEX Spot[168] states the need to accompany the electricity target model by an appropriate governance architecture at European level, applicable on Market Coupling activities, which will be crucial to ensure an efficient day-to-day operation of such complex mechanisms. The creation of regional TSOs with appropriate legal mandates would optimise the adoption of regional agreements between national entities.[169]

A stronger governance at EU level would also facilitate and improve the coordination between TSOs (see also the next point on technical coordination). With the

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[168] EPEX SPOT (2015)

[169] Juan José Alba Ríos (Chairman, EURELECTRIC Markets Committee Vice President Regulatory Affairs, ENDESA) suggested this issue in a meeting held on January 22th at Endesa premises (Ribera del Loira 60, Madrid, Spain).

introduction of the FBMC, bilateral coordination between TSOs was replaced by regional coordination among all CWE TSOs. However, some TSOs still apply different methodologies and this could be aligned.[170] Another example of voluntary cooperation/coordination is that TSOs create common daughter companies to deal with cross border issues and capacity allocation. This solution has been successfully implemented in CASC.EU[171], which was established to facilitate the calculation and allocation of transmission capacity.

Taking into account the crucial role of power exchanges in wholesale markets functioning and integration, the question arises to **what extent regulation of power exchanges is necessary and appropriate**. Various studies are stressing the need for regulation of power changes. A study concludes that the market power of power exchanges can be reduced by requiring more transparency and by introducing governance rules to prevent the formation of closed cartels among power exchanges.[172]

Market coupling requires more transparency and technical coordination for proper design and implementation

One of the major challenges is the technical co-ordination of the use of transmission infrastructure. The European power market model assumes that the national transmission networks, which constitute 'balancing zones' or 'market areas', are 'copper plates' and that possible congestions only occur in cross-border connections. TSOs calculate the transmission capacities available for cross-border trade, and make them available to the market participants via explicit or implicit auctions. The main difficulty is, however, the uncertainty concerning the physical path that market transactions are following in practice. Due to the zonal market model, market participants are not required to indicate the exact location of where energy is injected in and taken off from the grid. This means that when determining the capacity available to the market for cross-border trade, TSOs have only limited information about the physical flows, which is usually based on historical data.

The performance of the FBMC depends on the market zone configuration. Smaller market zones allow a better representation of the physical characteristics of the grid, resulting in a better performance of the FBMC. In this respect, it might be useful to reconsider the market zone configuration in Europe.[173]

Another critical issue is the **co-ordination** between the TSOs for **the capacity calculation and allocation process**. In order to ensure technically feasible market outcomes, when calculating and allocating cross-border capacity, all TSOs should take into account the possible influence of transactions carried out on their borders on power flows in neighbouring power systems. However, current practice in Europe shows that this is not always the case, especially in the CEE region. The most serious consequence of this insufficient co-ordination is a raft of unscheduled flows (also called unplanned power flows) occurring on a large scale in the European transmission network. Such unscheduled power flows become an important barrier to electricity market integration.

In order to reduce unscheduled flows, some TSOs have in the CWE region installed phase-shifting transformers (PST), enabling them to better manage the intermittency of cross-border flows on their borders. Power systems in CEE suffer from similar, often even more severe, problems caused by unscheduled (loop) flows, and consequently, some CEE TSOs have similar plans to implement PSTs. However, although PSTs are very effective and

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170 KU Leuven (2015b)

171 CASC.EU, created in 2008, is a central auction office for cross-border transmission capacity for CWE and various other European countries.

172 Meeus (2011) Why (and how) to regulate power exchanges in the EU market integration context?

173 KU Leuven (2015b)

useful tools to improve system security, they should be considered as a technical solution to mitigate the problem, and not as a means to address its root causes.

Intra-day and balancing markets should also be integrated at supranational level

The market coupling initiatives in CWE and CEE have been rather successful for the day ahead markets. Further substantial benefits can be realised by also coupling the **intraday and balancing markets**.

Intra-day markets are important to improve flexibility, competition and competitiveness as well as to reduce price volatility.

The European Commission has established a target model for the intraday market, based on continuous energy trading where interconnection capacity is allocated through implicit continuous allocation. The implementation of this target model is ongoing but the process is complex and slow due to a lack of an adequate governance model.

Diverging interests of the involved stakeholders (national authorities, regulators, TSOs, power exchanges) and the unclear regulatory framework are indeed leading to significant delays (more than three years for the intraday market coupling project). The integration of the intraday and balancing markets at supranational level should remain a top priority for politicians and stakeholders; a more liquid and representative market platform will allow to reduce the risks and costs of imbalances for market parties and TSOs.

National energy policies and market rules should be more harmonized

Diverging **national policies** are still hindering market coupling. In order to have an efficient market coupling, market policies should be harmonized to a certain extent in order to avoid distortions (such as existing injection tariffs and tax on primary fuel for generation[174]) and to have a level playing field. With market coupling and physical interconnection, markets are more sensitive to distortions in cost structure and pricing. The use of different taxes, levies and charges on power generation by Member States can influence investments and/or distort the functioning of the wholesale markets.[175] In order to fully integrate the electricity markets, as per European objectives, such distortions should be minimised. EURELECTRIC suggests that the EU process should facilitate coordination and provide more transparency on taxes, charges and levies to help member

[174] Other examples include:

- Additional carbon taxes by some member states (e.g. UK);
- Higher property taxes than generally applied, e.g. for hydro power in Finland, Norway and Sweden;
- Charging power plants with ancillary costs (e.g. Austria and Belgium) versus no ancillary costs for generators in other member states;
- Pumped storage in Belgium and Austria is subject to double grid fees and other charges such as policy support costs;
- Capacity based nuclear tax in Sweden, annually 1,4 ME/1000 MWth. Companies are considering in Sweden early closure of up to four nuclear units due to increase in the tax and low power prices;
- Some Member States impose taxes or levies on energy products used for power generation (gas, coal and even on hydro and nuclear power generation). These include nuclear fuel rod tax in Germany;
- Fiscal measures to reduce tariff deficit influence Spanish generators versus competitors in neighbouring countries;
- Different grid injection charges for power plants (EUR /MW) between member states (e.g. Belgium and Slovakia apply G-charges).

Source: EURELECTRIC (2015c)

[175] Taxes, levies and charges on power generation and storage inhibit the development of the internal electricity market, influence dispatch decisions, hamper investments in existing and new power plants and distort competition between technologies and across borders. The introduction of new taxes also increases regulatory risks. Fixed taxes/levies/charges influence mainly investments (and in some cases decommissioning/mothballing of plants), while taxes/levies/charges that are based on the volume of generated electricity influence both the operation of plants and investments. Source: EURELECTRIC (2015c)

states understand their consequences, particularly on cross-border trade.[176] Therefore, it is important to align the different existing national regulatory frameworks across Europe or to set up a new common framework altogether.

Interconnection capacity should be extended where necessary (in case of structural congestion) and its availability and use for commercial purposes should be maximised and optimised

Sufficient physical interconnection capacity must be available to value the synergy potential between neighbouring markets. This is currently still a bottleneck in the CWE and CEE regions (as well as in some parts of Europe). In order for market coupling to be efficient, the extension of the **physical interconnection capacity** should be a priority, in particular when there is a high level of congestion. The level of congestion and the price differential between 2 countries are in fact adequate criteria to assess the need for additional interconnection capacity.

A second important issue is the **availability of the physical interconnection capacity**. At the moment, TSOs determine the available capacity by excluding a (high) margin to ensure security of supply. There is a trade-off between the capacity made available for the market and that reserved for system security. A proposition made by CREG is that the regulator could calculate the available capacity instead of the TSO in order to ensure it is closer to the macro-economic optimum. Security margins reserved by TSOs for own operating purposes seems in practice rather high and could be reduced in order to maximise overall macro-economic benefits (in case of emergency TSO can 'repurchase' capacity from market party).

An appropriate methodology for calculation and allocation of cross-border transmission capacities is key to maximise the benefits of market coupling

TSOs, ENTSO-E, and ACER agree that a flow based methodology is the most appropriate approach for calculation of cross-border transmission capacities, as it brings the market as close to physics as possible. This opinion is also reflected in the Capacity Allocation and Congestion Management Network Code (NC CACM) developed by ENTSO-E, where flow-based capacity calculation and allocation (FBA) is established as the target methodology for the electricity market in continental Europe.

The effectiveness of the FBA mechanism requires appropriate market design and implementation. In zonal markets, such as in Europe, the FBA co-ordinates trade transactions between the bidding zones (market areas). This means that it is only able to fulfil its role as the co-ordination mechanism for cross-border trade, if transactions concluded within these bidding zones, entail no or little impact on power flows outside these zones. Bidding zones must hence be adequately designed. The process foreseen in the NC CACM of assessing the design of the bidding zones, has already been initiated, thanks to a broad consensus amongst stakeholders from the electricity sector, even though the Network Code is not yet approved.

It should be emphasised that the FBA Market Coupling mechanism with adequately designed bidding zones, is the only mechanism known today, which will ensure that the technical characteristics of the European interconnected power systems are duly taken into account in market processes, and that the transactions concluded by market participants are technically feasible. This mechanism should hence be implemented as soon as possible

[176] EURELECTRIC (2015c)

to contribute to the successful implementation of an integrated, common, EU-wide electricity market.

Finally, capacity allocation has a major impact on the effectiveness of market coupling. Most interconnection capacity is allocated via monthly or yearly markets or auctions, which allow market parties to conclude cross-border electricity trade contracts for the corresponding time horizon and capacity. In order to maximise the benefits of market coupling, capacity hoarding should be avoided and any unused interconnection capacity should be made available for implicit allocation to market parties in the day-ahead and intra-day markets.

Cross-border procurement of ancillary services (reserve capacity) should be stimulated

Ancillary services are currently mainly provided at the national level. However, they should be sourced at supra-national level to reach the macro-economic optimum. This would allow to share reserves across Member States, leading to considerable gains. TSOs need reserve capacity in order to be able to stabilise and restore if necessary the frequency of the electricity system. Cross border procurement of reserve capacity would enhance the competition in this market segment and offer macro-economic benefits.

A level playing field for power generators should be created

Market coupling enhances competition within the electricity sector and hence contributes to the competitiveness of the European economy. Power generators have indeed to compete in a larger market and their national market power is mitigated. This evolution makes it necessary for national governments to offer a level playing for all generators that are competing in the same supranational market. National policies and rules should be more harmonised in order to avoid competition distortion; at the present diverging national regulations exist that hinder fair competition, e.g. different tax levels on primary energy used for power generation, grid access rules and tariffs for power generation and large storage installations (in particular pumped hydro), capacity payments, emission standards.

Annex 4: Case study on whether an European approach for capacity remuneration mechanisms in the electricity sector is necessary and feasible

a. Executive Summary

As a result of market failures that prevent the electricity market to ensure that sufficient generation capacity is available to cover demand, various MSs have introduced capacity remuneration mechanisms (CRMs). However, uncoordinated national CRM initiatives can lead to competition and market distortions, and hinder further market integration. Taking into account these risks, the European Commission views CRMs as a last resort instrument to ensure generation adequacy and urges for a design of the mechanism in such a way that it does not distort the internal electricity market. We have identified four major design elements which should be considered in order to limit any negative impacts on the internal energy market:

- **Market-based CRM:** The payment should reflect the scarcity level in the market in order to avoid cyclical over- or undersupply.
- **Market-wide:** All technologies should be eligible to avoid competition distortion.
- **Open for participation of cross-border capacity:** Cross-border capacity should be able to participate, preferably explicitly to avoid competition distortion and to ensure security of supply at least cost.
- **More harmonised (or unique) CRM at supranational (regional) level:** More coordination and harmonisation of policies and market rules at regional level are necessary to avoid market and competition distortions, and to ensure security of supply at least cost.

b. Context

European Target Model for the electricity market

The Target Model (TM) of the European electricity market is the framework of the IEM and is based on an energy-only market.[177] In a well-functioning energy-only market electricity prices are determined by the demand and supply of electricity without any price regulation (no regulated prices and no price caps) and only the supplied electricity is remunerated (no specific capacity related remuneration).[178] Also, price signals in the short term market should ensure sufficient flexible capacity, whereas price signals in the long term market should ensure generation adequacy (i.e. sufficient capacity to cover peak demand). Variable and fixed costs of electrical energy generation are remunerated by the price of electricity and the revenues from supplying ancillary services to system operators (e.g. balancing energy and reserve capacity). In a normal market functioning, the price of electricity is determined by the variable costs of the most expensive unit (with highest variable costs) which is needed to meet the demand. This price allows generators to also recover (part of) their fixed costs. However, at times of scarcity, peak prices can occur which in theory can be equal to the value of lost load (VOLL).[179] These peak prices should allow generators to fully recover their fixed costs. In a market where there is no structural overcapacity, scarcity hours will in principle occur often enough and the accompanying scarcity prices should be high enough to ensure new investments.

[177] Van Driessche & Baeten (2015)
[178] Crampton et al. (2013)
[179] VOLL is the value that end users attribute to the energy that is not delivered.

Security of supply is one of the major goals of the EU energy policy. According to ACER an energy-only market will ensure security of supply and flexibility if the following conditions are met[180]:

- Unhindered price formation in the electricity market by balancing supply and demand, including for ancillary services;
- Sufficient elasticity of demand[181];
- Sufficiently frequent peak prices that may rise to the level of VOLL; and
- Regulatory and political stability in the market. Investors must be confident that they can recover their investments costs in new capacity.

Inadequacy of the energy-only market and its consequences

At the moment, not all of the above conditions are fulfilled. First of all, the **price formation** in the wholesale electricity market is not yet fully deregulated in Europe and several MSs have still regulated retail prices. Moreover, **electricity demand is still rather inelastic**, as the price elasticity is low and the tools to facilitate demand side management at large scale are not yet implemented in most Member States. Tools for effective demand side management (such as smart meters, smart appliances and dynamic end-user pricing formulas) are only available in some MSs and for specific market segments. Moreover, there is a lack of information on opportunities for demand side management. Also, storage capacities are rather limited in most MSs and their use is often not economically optimised due to inadequate grid tariffs and national legislation. Furthermore, **peak prices do not occur frequently and are not high enough to trigger investments in (not subsidized) new capacity**. Moreover, potential investors fear that frequent and/or long periods of peak prices would politically and socially be considered as unacceptable and that governments and regulators would be inclined to intervene in price formation by putting a cap on the price, which would prevent electricity generators to recover their fixed investment costs. In this context, generators in Europe are not investing any more in new conventional power generating capacity and are even decommissioning gas power plants prematurely, due to the 'missing money problem'.

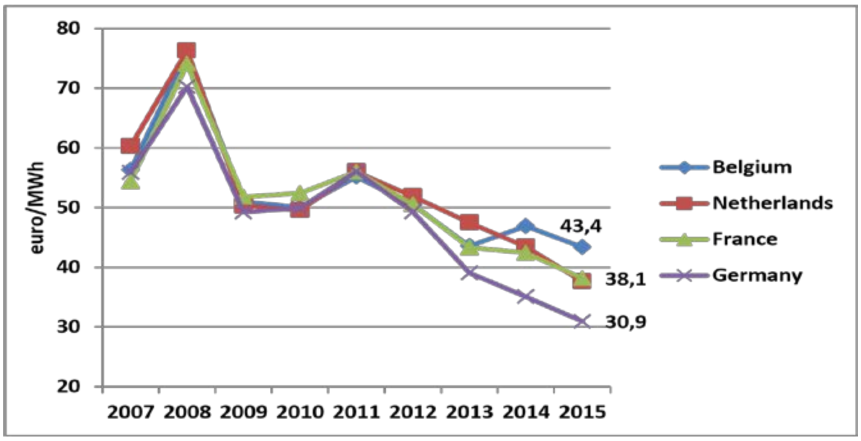
The increasing share of renewable energy results in a higher need for flexibility due to their intermittent character (solar, wind). Therefore, the IEM should ensure that sufficient flexibility sources (supply and demand) are available at any moment to keep the electricity system in balance. On the other hand, market price signals should also ensure long-term generation adequacy; this is currently threatened by the very low and further decreasing profitability of conventional power plants as a result of the negative effect of intermittent RES on the overall price level (merit-order effect) and on the load factor of conventional power plants, which decreases the return on investment of conventional power plants. To illustrate this effect,

Figure 19 shows the decrease of average year-ahead future price of electricity in the CWE region resulting in decreasing profitability of conventional power plants.

[180] Van Driessche & Baeten (2014)

[181] The elasticity of demand, also referred to as the price elasticity of demand, measures how responsive demand is to changes in a price of a good/service. More precisely, it is the percent change in quantity demanded relative to a one percent change in price, holding all else constant (ceteris paribus).

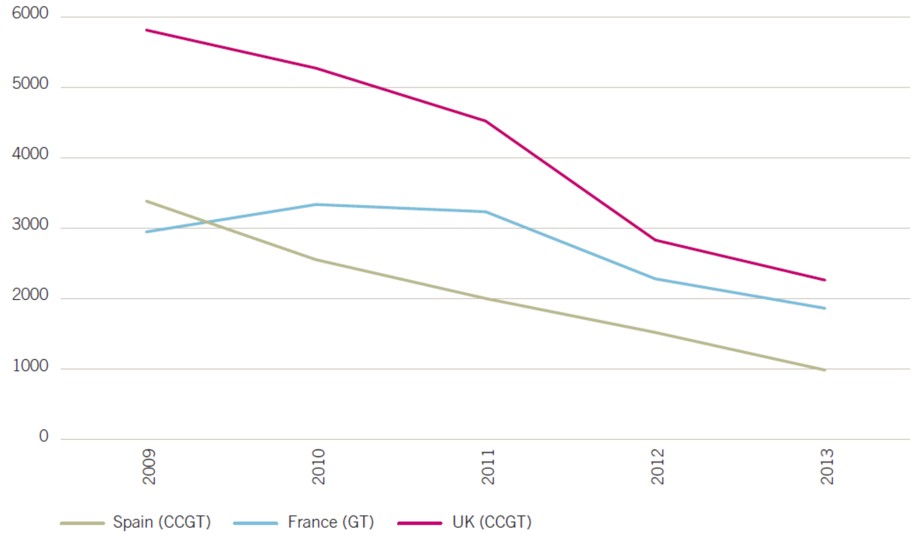
Figure 19: Average year-ahead future price of electricity in CWE in 2007-2015



Source: CREG, 2015

The decreasing profitability of gas-fired power plants is the consequence of lower wholesale price levels, less operating hours (see Figure 20) and lower efficiency (more starts up and shuts downs) of this type of generation assets. This has resulted in the decommissioning or mothballing of several gas plants in Europe, although they are more energy efficient and sustainable than coal plants, and in some cases necessary to ensure security of supply.

Figure 20: Decrease in operating hours of EU gas-fired power plants in 2009-2013



Source: Coibion, A. & Pickett, J. Linklaters (2014)

Capacity Remuneration Mechanisms in order to ensure generation adequacy

As a result of these factors that prevent the electricity market to ensure that sufficient generation capacity is available to cover the residual demand at any time[182], various MSs have introduced capacity remuneration mechanisms (CRMs). CRMs provide an investment incentive for new firm (reliable) generating capacity and an incentive to keep existing generation stack available to the market through a capacity-based payment. In some schemes, reduction in peak load (demand response) and RES capacity are also eligible for

[182] The residual demand is equal to the overall final demand for electricity minus the consumption which is covered by the own generation assets of end-users (prosumers and auto-producers)

capacity payments to the extent that they contribute to balancing supply and peak demand.

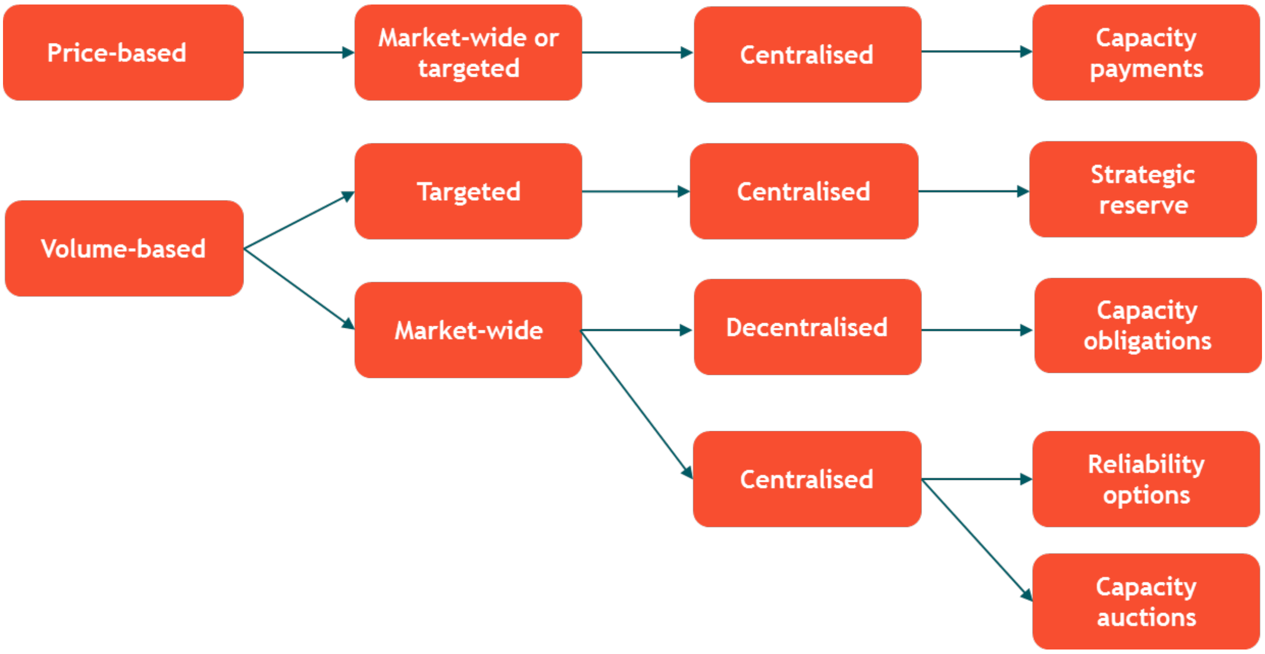
c. Description of CRMs

CRMs remunerate the availability of firm capacity (which can contribute to cover the peak demand) on top of the remuneration for delivering electricity. In this way electricity generators can recover their fixed costs. The costs of capacity remuneration mechanisms are in principle allocated to the end users, via the grid fee (e.g. strategic reserve) or via the suppliers' tariffs (e.g. capacity obligations).

Types of CRM

Different types of remuneration mechanisms exist, namely strategic reserves, capacity payments, capacity auctions, capacity obligations and reliability options.

Figure 21: Overview of different types of CRMs



Strategic reserves generally consist of older conventional generating units that are taken out of the market and are only used in case of emergencies when insufficient commercial capacity is available to cover the residual peak demand. An independent party (typically the TSO) can activate the capacity when the price exceeds a certain threshold price (e.g. 3,000 EUR/MWh), indicating scarcity of supply. The volume that is needed as a strategic reserve is determined by the regulator or government. A tender procedure can be used to determine the suppliers of the reserve capacity and the price they receive for it. In order to give clear signals to the market, the imbalance price paid by market parties that are in a short position during the activation period of the strategic reserve should be higher than the highest bid.[183] Imbalance prices above the highest bid will create larger incentives to deploy demand response and to invest in capacity. Only small changes to the existing market rules and regulation are needed to implement a strategic reserve. A disadvantage of a strategic reserve is that the threshold (and imbalance) price is set by the regulator (not determined by the market). In case this price is set too low, it can create market distortions and demand response or capacity investments are impeded. Furthermore, a

[183] KU Leuven (2013)

strategic reserve can solve the problem of adequate generation capacity during peak demand, but in principle it reduces the price level (less/lower price peaks) and hence the willingness to invest in peak power plants.

Capacity payments are a specific remuneration scheme for suppliers of firm (typically conventional) generating capacity in addition to the price of electricity they receive at the market. The remuneration levels are determined beforehand by an independent administrator (e.g. regulator) and may vary per technology. It is based on the level of future demand and an assumption on the level of investments in capacity resulting from the capacity payments. Via electricity suppliers the costs are allocated to the end-consumers. This type of CRM is the easiest to implement to reduce the risk of generators and hence stimulate new investments.

Capacity obligations are a decentralised mechanism that obliges electricity suppliers and large end-users to contract a certain amount of firm capacity equal to their estimated future delivery obligations to end users (for electricity suppliers) or their expected residual peak consumption plus a security margin (for large end-users). The regulator or TSO determines this capacity. The obligated parties can own or obtain the capacity themselves or conclude contracts with producers and/or large users (via peak load shaving). An independent party needs to certify the guaranteed availability of capacity before the contract is signed. A penalty is imposed in case parties cannot respect their obligations. The costs are allocated to end-users via the electricity suppliers.

Capacity auctions are similar to capacity obligations, but an independent party (e.g. NRA or TSO) determines the overall capacity that needs to be available for the electricity system (e.g. a country or a balancing zone), taking into account the expected future residual peak load and a reserve margin. A centralised auction is held for the availability of capacity in the delivery year and a clearing price is determined by the bids and offers submitted. Similar to capacity obligations, an independent party needs to certify the guarantees submitted by capacity suppliers. Penalties exist for non-availability of capacity during peak periods.

Reliability options are a quantity-based mechanism whereby an additional market for capacity is created next to the energy market. Reliability options are call-options that are auctioned in this capacity market. The volume of the options is determined by the system operator and is based on an estimation of the future peak load plus a security margin. The options are bought by the system operator from generating companies and the price of the options is determined by the market for options. The price level in the energy market determines whether the option is called or not. In case the wholesale price is below a certain price (the strike price[184]) the option is not called. However, in case the wholesale price exceeds this strike price (and a scarcity situation occurs) the option is called by the system operator. Contracted capacity providers are then obliged to pay the difference between the wholesale price and the strike price to the system operator for each option they have sold.

In case these contracted parties were not producing at times of scarcity, they will have to pay the difference between the wholesale price and the strike price without receiving any revenue from the electricity sold (hence, a net loss). In this way, reliability options provide an incentive for the contracted generators to be available at times of scarcity.

The costs for call-options are partly reimbursed by the payment of the generating companies to the system operator in case of scarcity period and partly by a tax or

[184] The strike price is centrally determined by the system operator

surcharge on the energy price for consumers. So far, no EU MS has implemented a reliability option, but it has been implemented in Colombia and New England.

The table below provides an overview of the different types of CRM and their characteristics.

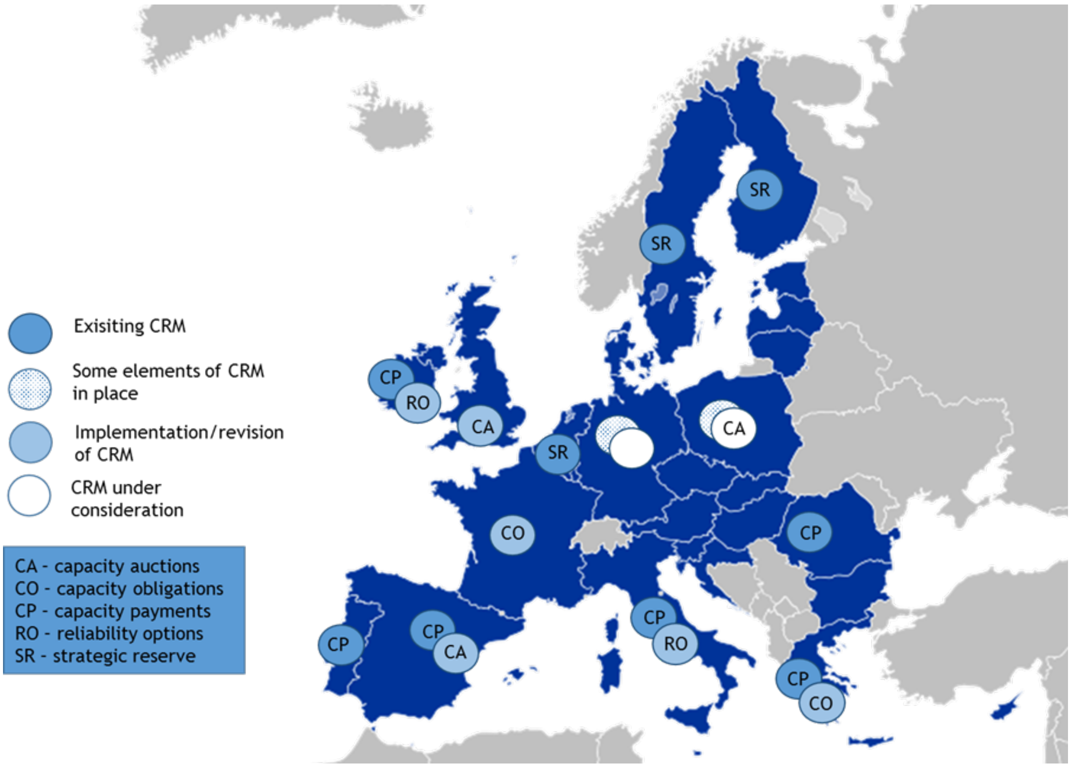
Table 14: Characterization of the different types of CRM

Type of CRM	Strategic reserve	Capacity payments	Capacity auctions	Capacity obligations	Reliability options
Price/volume based	Volume	Price	Volume	Volume	Volume
Centralised / decentralised	Centralised	Centralised	Centralised	Decentralised	Centralised
Targeted / market-wide	Targeted	Targeted	Market-wide	Market-wide	Market-wide
Ease of implementation	Easy	Easy	Rather easy	Complex	Rather easy
Penalties	-	-	Yes	Yes	-
Payment of the option	End-users (allocated by administrator)	End-users (via suppliers)	End-users (via suppliers)	End-users (via suppliers)	End-users (via suppliers)
Reduction of investment risk / incentive for new investment	No	Yes	Yes	Yes	Yes

Status of implementation across EU

Below an overview is given of the Member States that have either implemented or are considering the introduction of CRMSs.

Figure 22: Capacity mechanisms in Europe in 2015



Source: based on Hancher, De Houteclocque & Sadowska (2015)

Recently, new designs of CRMs have been implemented in France and the UK:

Capacity obligations in France

In France capacity obligations are being implemented and are supposed to be operational for the winter period of 2016-2017. The French government has established this CRM based on three fundamental principles[185], namely:

- The mechanism should be market and volume-(capacity) based
- It should be market-wide (both supply and demand response should be eligible)
- It should include the assignment of individual obligations that can be met by purchasing certificates from a third party (decentralised).

A market-based mechanism was chosen as it is cost-efficient: trading should minimize the costs of the capacity obligations[186]. It also ensures efficiency and that the right incentives are created to enable demand side response. A decentralised model in which obligated parties must anticipate the needs of their customers and are financially liable in case of imbalances has similar design elements as the energy market.

The level of obligations for each supplier will be based on the peak demand of its customers. Suppliers will be obliged to obtain certificates by either certifying capacities they own and operate or by purchasing certificates issued by the French TSO (RTE). Obligations will be set four years before the delivery year. Existing generators must request a certification for their capacities at least three years before delivery year, whereas demand-side operators and planned generation capacities can request certificates until two months before the start of the delivery year. This deadline creates economic signals for the capacity

[185] French Decree 2012-1405 of 14 December 2012
[186] RTE (2014)

market to develop enough capacity to meet the security of supply criterion. The suppliers' obligations are based on their customers' contribution to the shortfall risk during peak periods. Hence, consumers who do not consume electricity during peak periods, do not have a capacity obligation.

Table 15: Overview of design elements of the French CRM

Design elements	French CRM design
Contract	Obligation in times of system stress
Obligated parties	Suppliers, end-consumers that are not supplied by suppliers (auto-producers), and system operators (for their grid losses)
Price / quantity based	Quantity-based
Determination of individual obligations	This will be based on the projected contribution of their capacities to reducing the shortfall-risk during peak-periods.
Cross-border participation	Implicit cross-border participation. Eventually the goal is to include explicit cross-border participation.

In November 2015 the European Commission announced that it has opened an in-depth investigation to assess whether the French capacity mechanism is in line with the EU State aid rules.[187] The Commission is concerned that the French system of capacity obligations would favour certain market parties and that the entry of new suppliers would be hindered. Also, the Commission will investigate whether other measures - that are less costly and less distortive to the market - could be implemented in order to ensure security of supply and whether the proposed mechanism will create enough incentives for new capacity investments.

Capacity auctions in the UK

As part of the Electricity Market Reform package of the UK government, a capacity auction has been installed in 2014. This mechanism was implemented to encourage investments and provide backup for RES.[188] Also, it aims to increase demand side management. Both a four-year ahead auction and a one-year ahead auction are held. The capacity market is designed in multiple phases: capacity to procure, auction, trading, delivery and payment.

Demand side response and electricity storage are eligible to provide capacity. Electricity demand reduction is not yet eligible, but is currently subject to a pilot. Low carbon capacity is not eligible if they receive another form of support. Providers of Short-Term Operating Reserve are not allowed to participate unless they terminate their contract if awarded via the capacity auction. Providers can offer capacity and balancing services and can receive a payment for both. Interconnection capacity is not eligible but its participation is under assessment. Eventually, the UK aims to enable foreign generators to participate explicitly.

The key design elements of the UK CRM are presented in below. Table 17 shows an overview of the actors and their roles and responsibilities in the UK's CRM.[189]

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[187] EC (2015b) - COM(2015) 82
[188] https://www.gov.uk/government/collections/electricity-market-reform-capacity-market
[189] COM(2014) 5083 final

Table 16: Key design elements of UK's capacity market

Design elements	UK CRM design
Contract	Availability obligation in times of system stress
Eligible parties	• Conventional generation capacity (existing and new), storage, DSR • Capacity providers that already receive support from other measures are excluded (e.g. support through Contracts for Difference or Renewables Obligation) • Interconnection capacity eligible from 2015 onwards
Commitment	Penalties for non-delivery and payment for over-delivery of capacity obligation are in place
Price / quantity based	Quantity based
Determination of quantity procured	System operator will advise the Government on the level of capacity needed taking into account future capacity markets, interconnection capacity and DSR. The Government will decide the final level of capacity in each auction on the basis of a demand curve.
Auction parameters	Cost of new entry, price cap, price-taker threshold, target capacity tolerances
Auction process	Centralized auction with pre-qualification criteria. Pre-qualification requirements will vary for the different types of capacity
Cross-border participation	Implicit participation from 2015 onwards

Table 17: Governance structure of UK's capacity market

Actor	Roles & responsibilities
The Government	• Design Regulations[190] and Rules[191] regarding the CRM • Responsible for strategic oversight and changes to the Regulations governing the scheme • Needs to ensure continued accountability for the design of the CRM • Determines auction parameters
Regulator (Ofgem)	• Responsible for amending the Rules defined by the Government • Needs to take into account the Regulations in case it wants to change the Rules • Responsible for the resolution in case of disputes

[190] The Regulations include for instance general eligibility criteria to participate in auctions and the functions and responsibilities of the different actors

[191] The Rules include technical rules and procedures concerning the auction, the content of capacity contracts and obligations to contract holders.

	between applicants about the outcome of the pre-qualification
Delivery Body (National Grid)	• Delivery role for the Capacity Market: advice to Ministers on the level of capacity needed to be auctioned, pre-qualifying applicants, administering the auctions, issuing the contracts, developing new supporting procedures
Settlement Body (new installed private company owned by the government[192])	• Responsible for the governance, and control of the settlement process and payments disbursed under contracts • Responsible for setting own internal governance controlled by the Government
Settlement service provider (Elexon)	• Responsible for carrying out calculations and determinations of capacity payments

In July 2014 the EC approved the UK CRM as it aims at securing the energy supply in the UK market, it is in line with EU objectives and without distorting the internal energy market.[193] As it is also in line with the Environmental and Energy State Aid Guidelines, lessons can be learned from the UK case. Before introducing the capacity mechanism, the UK investigated the need to implement it and has considered several alternatives[194]. The UK System Operator will organise a centralized auction to procure the level of capacity required to ensure security of supply to minimise the aid granted[195]. The auction will be open for both existing and new generators, demand side response and storage operators and furthermore it will be open for participation of foreign capacity which can be made available to the UK market via the interconnectors[196]. The capacity will be auctioned one year ahead. New generating capacity is eligible for a 15-year contract, whereas existing generating capacity only for 1-year contracts[197]. A levy on electricity suppliers will finance the capacity mechanism.

d. Analysis

Arguments in favour of the introduction of a CRM

Capacity mechanisms can solve the missing money problem if they are designed and implemented properly. Structural capacity remuneration leads to lower financial risks for generators and hence incentivizes them to keep existing capacity in operation and to invest in new capacity in order to ensure generation adequacy. The overall revenues (electricity + capacity) of generators will in general not be substantially higher than in an energy-only market, as price peaks will in principle be lower and will occur less often. Electricity producers are in this context less dependent on (unpredictable) scarcity prices and become more inclined to invest in new assets. Wholesale prices will be more stable as a result of lower price volatility (price peaks are lower). Furthermore, it will provide an incentive for demand side response, as an extra remuneration based on capacity will be created and

[192] The company will be able to set its internal governance, but the government has overall control over the company.
[193] COM(2014) 5083 final
[194] in line with section 3.9.1-3.9.3 of the EEAG
[195] in line with section 3.9.5 of the EEAG
[196] in line with section 3.9.6 from EEAG
[197] thereby providing incentives for new generators as in line with section 3.9.3

providers of demand side response are no longer dependent on price volatility only. Countries in which a CRM is implemented seem to have higher implementation rates of demand side response.

Arguments against the introduction of CRM

Opponents of CRMs argue that it is not an appropriate solution to ensure security of supply. First of all, CRMs result in additional complexity of the electricity market design, and higher administrative costs (e.g. overhead and transaction costs).

A study by Frontier Economics and Formaet[198] analysed the German electricity market and provided an alternative to the introduction of CRMs by presenting amendments to the current energy-only market design in order to ensure security of supply. The removal of market entry barriers for demand side response and unconventional production plants can result in a larger price elasticity of demand in a scarcity situation. Also, market operators (including 'dominant' market parties) should be legally allowed to bid above their variable cost in order to also recover (part of) their fixed costs and power exchanges should increase the technical price limit. In this way, price caps (both explicit and implicit) are prevented and prices will reflect scarcity. Moreover, incentives should be created to balance generation and consumption, for instance by the introduction of marginal pricing for balancing energy. With marginal pricing, rather than average cost based pricing, balancing responsible parties are financially incentivized to actively support the system as they get an additional revenue if their imbalance supports the system[199] and will be penalized if it does not support the system.[200] With these measures and some accompanying initiatives to ensure stability of the framework and international coordination, the energy-only market would provide generation adequacy to ensure security of supply and hence a CRM would not be necessary.

e. Challenges and bottlenecks of implementing CRMs

CRMs must be compliant with the EU guidelines

In line with the mentioned risk of market and competition distortions as a result of diverging national CRMS, the EC views CRMs as a last resort instrument to ensure generation adequacy and urges for a design of the mechanism in such a way that it does not distort the IEM.

In November 2013 the EC published a staff working document offering guidance to ensuring generation adequacy in the IEM.[201] In June 2014, the EU has published guidelines regarding CRMs that may have an effect on the design of both existing and new national CRMs.[202] In these documents the EC stated that in principle, energy-only markets should provide enough investments incentives. To ensure security of supply in the long term generation adequacy assessments should be made by Member States taking into account developments at a regional and European level, European policy objectives and demand response possibilities. In the case that this assessment results in a concern on security of supply, the causes of this concern must be identified and an objective and fact-based analysis on the actual size of lack of generation adequacy must be done. Member States

[198] Frontier Economis & Formaet (2014)

[199] Parties will receive a bonus in case they produce less/more than their schedules in case of an oversupply/undersupply respectively.

[200] Parties will be penalized in case they produce more/less than their schedules in case of an oversupply/undersupply respectively.

[201] EC (2013) - SWD(2013) 438

[202] EC (2014b)

should aim to remove the causes of this threat to security of supply and maintain an energy-only market if possible. **Only as a last resort, capacity mechanisms should be implemented in a way that distorts competition as little as possible**. Preferably a technology-neutral tender procedure that is also open for parties outside the concerned Member State should be opted for.

In April 2015, the European Commission has stated that CRMs may include State aid[203] and has announced an investigation into the CRMs of several Member States in order to assess whether they comply with the State aid regulation[204]. If a CRM implies State aid, the concerned Member State must indeed notify it to the EC in order to assess its compatibility with a.o. Article 108(3) of the TFEU and the Energy and Environmental Aid Guidelines (EEAG)[205], which have been adopted in 2014 and include specific criteria to assess State aid for CRMs.

EU guidelines regarding CRM

If a policy measure includes State aid it needs to be compatible with the internal market rules which is assessed on the criteria specified in Article 27 of the EEAG; these are elaborated more specifically for generation adequacy in section 3.9 of the EEAG:

a) ***"Contribution to a well-defined objective of common interest"*** A MS should consider an impact that does not contradict the aim of phasing out harmful subsidies. The objective should be clearly defined including size and location of the lack of generation adequacy.
b) ***"Need for State intervention: aid can bring about a material improvement that the market alone cannot deliver"*** MSs should demonstrate why the market cannot deliver adequate generation capacity taking into account future market and technology developments. Assessments of the impact of variable generation, demand-side participation, the current and potential interconnectors will be included.
c) ***"Appropriateness of the aid measure: the proposed aid measure is an appropriate policy instrument to address the objective of common interest."*** MSs should remunerate only the service of availability of capacity and not the sale of electricity. The measure should provide incentives to existing and future generators, providers of demand-side response and of storage capacity. Different lead times should exist for the different technologies. Also interconnection capacity as a solution the generation adequacy problems should be taken into account.
d) ***"Incentive effect: the aid changes the behaviour of the undertaking(s) concerned in such a way that it engages in additional activity which it would not carry out without the aid or which it would carry out in a restricted or different manner."*** No specific guidelines are provided for generation adequacy, but general criteria are provided in section 3.2.4 of the EEAG.
e) *"**Proportionality of the aid: the aid amount is limited to the minimum needed to incentivise the additional investment."*** The amount of aid to ensure generation adequacy should result in reasonable rate of returns, which can be accomplished by a competitive bidding process with clear, transparent and non-discriminatory criteria. Windfall-profits should be avoided and in case capacity supply is expected to meet capacity demand no remuneration should be paid. *"**Avoidance of undue negative effects on competition and trade between Member States: the negative effects of aid are sufficiently limited, so that the overall balance of the measure is positive."*** The measure should be designed so that generators using different technologies and operators offering other measures (e.g. demand-side management, storage, interconnectors) can all participate. Restrictions to participation should only be made if sufficient technical performance cannot be ensured. Operators outside of the MS should be allowed if it is physically possible and a sufficient amount of operators should participate. Negative effects on the internal market should be avoided, such as price caps on wholesale prices or bidding restrictions. Moreover, the measure should not undermine investments in interconnector capacity and in generation capacity (that were already planned), market coupling or decisions regarding the balancing and ancillary services market. Also, it should not result in market power abuse and preference should be given to low-carbon technologies in case of equivalent technical and economic performance.
g) ***"Transparency of aid: Member States, the Commission, economic operators, and the public, have easy access to all relevant information about the aid."*** No specific guidelines are provided for generation adequacy, but general criteria are provided in section 3.2.7 of the EEAG.

[203] The definition of State aid is defined in Article 107(3) TFEU
[204] EC (2015a)
[205] EC (2014b)

Diverging national CRMs can lead to market and competition distortions

The diversity of capacity mechanisms across MSs results in the risk of competition distortion and hence hinders the integration of the IEM. Bidding processes in the electricity cross-border wholesale markets and markets for ancillary services will indeed be affected by national policies to grant capacity payments to specific technologies or to capacity located in their own territory. A lack of harmonisation at a supranational (regional or European) level results in the risk of distortion of competition amongst technologies and/or operators that are competing in the same integrated regional market. Decisions of governments to support existing uneconomic assets can also have an impact on the price formation and hinder the transition to a low carbon electricity supply.

g. Assessment of the impact of national CRMs on cross-border markets and internal energy market

Impact dependent on CRM type and its operation rules

The impact of a CRM on the internal energy market is dependent on the type of CRM and its concrete operation rules. In case of a strategic reserve, the impact mainly depends on the level of the threshold price. When this price is high enough (e.g. 3,000 EUR/MWh), the impact on price formation and hence on the IEM is limited. Strategic reserves can however not be considered as an appropriate structural solution; it should only be used as a transitional temporary measure and for a limited volume. Regarding payments for capacity (both capacity payments and reliability options), which are often implemented in combination with a price cap, the impact on the IEM depends on the level of payments and the eligibility criteria (technology-neutral or technology-specific). When the payments are limited to specific technologies and are not fixed at the right level, the CRM can have a disturbing impact on investment decisions and therefore on the energy mix. The risk of flaws in market design appears to be larger for capacity markets (capacity obligations, reliability options and capacity auctions) compared to a strategic reserve for which only small adjustments to the market design are required.[206] In the long term CRMs can discourage investments in new capacity in case the CRM puts a cap on the market price (e.g. by setting the threshold or strike price too low), which might result in scarcity of peak-load capacity.

Impact dependent on level of cross-border participation

The impact of CRM on the IEM integration depends on the extent to which cross-border participation is permitted.[207] Foreign generation capacity can be included in two ways: Explicit (directly allowed to participate in the procurement or tendering process) or implicit (where the interconnection capacity can be included as a source of system reliability).[208] Explicit participation results in higher benefits but is also more complex to implement.[209]

In the short term CRMs influence neighbouring electricity markets, in particular if these are strongly interconnected. In case a threshold price or strike price for the activation of the CRM is too low, the market cannot accurately signal scarcity and this problem can be exported to neighbouring countries. When these countries don't have a CRM, they can in the medium term get security of supply problems, as market prices will not indicate scarcity and hence will not trigger investments in new generating capacity.

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[206] Meyer & Gore (2015)
[207] Van Driessche & Baeten (2015)
[208] CIEP (2012)
[209] Fontaine et al - Market4RES (2015b)

In case the design of a national CRM does not take into account that cross-border capacity can contribute to security of supply via the interconnectors, the risk exists that too much capacity is contracted via the CRM. It is also possible that spill-over effects occur, if a country (without CRM) benefits from the CRM implemented by its neighbouring country. Energy producers outside the country are in disadvantage if they are not allowed to contract for capacity within the framework of the CRM, which is harmful for the competition and cross-border trade and hence the IEM.

When one country implements a CRM and a neighbouring country that is part of the same integrated regional market does not, and cross-border participation of capacity providers is permitted, this can result in a shift of capacity towards the market that has implemented the CRM.[210] A study by Meyer & Gore analysed the cross-border effects of both strategic reserves and reliability options showing that a strategic reserve tends to narrow down the market and increase price levels whereas reliability options intensify price competition.[211]

Mastropietro et al. identified two main barriers to cross-border participation in CRMs.[212] The first is related to mistrust to fulfil article 4.3 of the Security of Supply Directive (2005/89/EC) stating that "Member States shall not discriminate between cross-border contracts and national contracts". Most national legislation includes clauses that imply that in case of domestic emergency of supply electricity export to neighbouring countries will be disrupted. This means that in case of concurrent scarcity conditions, TSOs will limit interconnector flows and hence market operators will not be able to fulfil their contract. In order to remove this barrier, appropriate network codes and operation procedures are needed and the responsibility of ensuring security of supply should be transferred from the system operator to the market operator. The second barrier to cross-border participation in CRMs is related to the fact that in case the Target Model is strictly applied, transmission capacity will automatically be allocated via a central clearing algorithm. The transmission flows will largely be determined by price differentials between countries. In some cases, this may imply that actors are not able to fulfil their CRM contracts during scarcity conditions. This can result in the paradoxical situation in which transmission capacity increases the amount of capacity procured and might lead to an overinvestment in the country that has implemented a CRM.

h. Key lessons learnt from the current practices and from studies

Lessons learnt from current practices

Market-based instruments appear to be more efficient and less distortive than price-based instruments. Implemented price-based designs are currently redesigned due to inefficiencies (e.g. in Spain, Italy and Ireland). Also, an important design element is the inclusion or exclusion of interconnector capacity. Explicit participation of interconnection capacity would be most beneficial, although this can be complex and difficult. In the UK, foreign generation units are taken into account on the supply side (i.e. foreign capacity might participate in future auctions), whereas in France foreign generation units are accounted for on the demand side (i.e. de-rating level of obligations by an amount equal to the capacity that foreign generation units can contribute to peak load.[213] The EC stated that the UK's design is in line with the Guidelines on State Aid. Other practices are awaiting approval by the EC.

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210 RAP (2013)
211 Meyer & Gore (2015)
212 Mastropietro et al. (2015)
213 Karsten & Schwenen (2014)

Lessons learnt from studies

A Market4RES study[214] evaluates various design elements of CRM with long-term effects.[215] The study concludes that financial options with a **high strike price** (above variable cost of peak power plants) seem to be the most appropriate. In this way a balance is achieved between certainty for investors to invest in firm capacity (long-term markets) and incentives to participate in short term markets. A **centralized auction** would be preferable to ensure effective and efficient allocation of capacity. Also, the **supply requirement should be price elastic and expressed by means of a price-quantity curve** to avoid over- or under-contracting. Lastly, **cross-border provision of firm capacity should be allowed**.

Market4RES[216] stresses that, in order to deploy firm capacity at a reasonable cost and without increasing the cost of system operation, capacity should be contracted in a coordinated way: competition among potential firm capacity providers should be allowed all over Europe. Also, the design of the CRM must ensure that is does not interfere with short-term market signals.

A study by the University of Tilburg[217] showed that a price cap in a low carbon electricity system will negatively affect investment levels to a greater extent than in a system with less RES. This efficiency can be restored by implementing a **technology-neutral capacity payment** where the payment size is independent of the amount of RES in the system. A study by the Institute of Energy Economics (University of Cologne)[218] shows that cross-border effects from different CRM choices can result in negative welfare effects for individual countries.

Eurelectric developed a CRM reference model where only the capacity that is absolutely necessary to ensure security of supply in the long-term should be remunerated.[219] Every CRM should follow basic design elements to maximize cost-efficiency and be coordinated at a regional level, requiring regional adequacy assessments.[220] TSOs should closely work together to manage the infrastructure so that contracted assets can contribute to the security of supply at a regional level. Preferably, the same CRM model should be adopted at regional level, but as a stepping stone cross-border participation should be implemented into national CRMs. In the model, the market participant is the cross-border generation (or DR) capacity provider and the traded product is the availability of capacity. Cross-border grid capacity should not be reserved in order not to distort the functioning of existing markets.

i. Recommendations

The need to create a European framework for CRMs to avoid further national distortions is currently being discussed policy makers and stakeholders.[221] Four major elements should be taken into account when designing or redesigning a CRM at national or supranational level:

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214 Flament et al. - Market4RES (2015a)
215 Based on Battle et al (2015) in Flament et al. - Market4RES (2015a)
216 Fontaine et al - Market4RES (2015b)
217 Willems (2014)
218 Elberg (2014)
219 Eurelectric (2015b)
220 The Pentalateral Energy Forum has already made an approach to assess generation adequacy at a regional level. See Pentalateral Energy Forum (2015)
221 Eurelectric (2016)

- **Market-based:** An efficient capacity remuneration mechanism will positively affect the capacity reserve margin, which in turn will have a decreasing effect on the market price (less and lower price peaks) and restrain new investments in capacity. For that reason, a market-based CRM is the most appropriate solution; in such a scheme the capacity payment which is determined by the market automatically reflects the scarcity level and keeps the demand-supply level structurally in balance. If authorities or regulators determine the price administratively, it will not correctly reflect the scarcity of capacity, and might lead to cyclical over- or undersupply.
- **Market-wide:** All technologies should be eligible to participate in the CRM, including DSM and the 'firm' part of RES. In this way the distortion of competition will be limited. Also capacity that already receives support via another instrument (e.g. RES support mechanisms) should be included, but the support should be adjusted in order to avoid overcompensation.
- **Open for participation of cross-border capacity:** Preferably, foreign generation/storage or demand response capacity should be able to participate in the CRM explicitly. This will necessitate more coordination amongst authorities and regulators and also TSOs will need to closely cooperate to determine the possible contribution of foreign capacity to the system reliability and to agree on the calculation and allocation rules of cross-border grid capacity.
- **More harmonised (or unique) CRM at supranational (or regional) level:** More coordination and harmonisation of policies and market rules at regional level are necessary to avoid market and competition distortions, and to ensure security of supply at least cost. In this context more harmonised or even a unique CRM at supranational level would be more appropriate than diverging national CRMs.

Annex 5: Case study on how non-market based allocation of limited cross-border gas capacities at the Austrian-Hungarian entry point led to market distortion and to conflict with EU regulations

a. Executive summary

Hungary had until July 2015 only two gas entry points: at the Austrian and Ukrainian borders. Historically, the majority of the gas was imported through Ukraine, in the framework of the Long Term Contract (LTC) with Gazprom. In 2009, as gas prices in Austria dropped below the Hungarian-Russian LTC prices, the demand for gas import from Austria increased to such an extent, that a shortage of physical capacities occurred at the entry point.

In Hungary, the gas market was liberalized in July 2008, by the new Gas Act. The Implementing Regulation was introduced in July 2009. In applying the new regulation, the TSO announced a planned auction in March 2010. In April 2010, however, a new ministerial decree postponed the first auctions to the gas year 2012/2013. In 2011, the Hungarian Energy Office ceased the auctioning procedure, and nearly all available capacity rights were allocated via a ministerial decree (April 2011) exclusively to two companies. Partly due to this political decision, other gas traders left the market.

This decision violated the provisions of Directive 2009/73/EC and Regulations 1775/2005 and 715/2009/EC. It also hindered competition as well as investments in the gas sector, and undermined the trust of foreign investors.

In July 2015 the ministerial decrees were withdrawn. Since then, network capacities are traded on the Regional Booking Platform, an electronic auction and capacity trading platform developed on the basis of Regulation 984/2013/EU. Although the decrees were not compliant with EU regulations, the EC only launched an infringement procedure in February 2015, with a formal notice about the "Compliance with the provisions of the Third Energy Package in Hungary". The content of the notification is not publicly known, however, as media[222] revealed, the violation of the regulation on cross-border capacities was also on the agenda.

b. Context

Gas supply infrastructure in Hungary

Table 18: Relevant statistics for natural gas in HU

Interconnection capacities for natural gas	2011	2015
Western entry point (from Austria):	Official: 12,1 million m^3/day potential (theoretical): 14,4 million m^3/day	Official: 12,1 million m^3/day potential: 14,4 million m^3/day
Eastern entry point (from Ukraine):	56.3 million m^3/day	56.3 million m^3/day
Eastern exit point (to Ukraine)	NA	16,8 million m^3/day

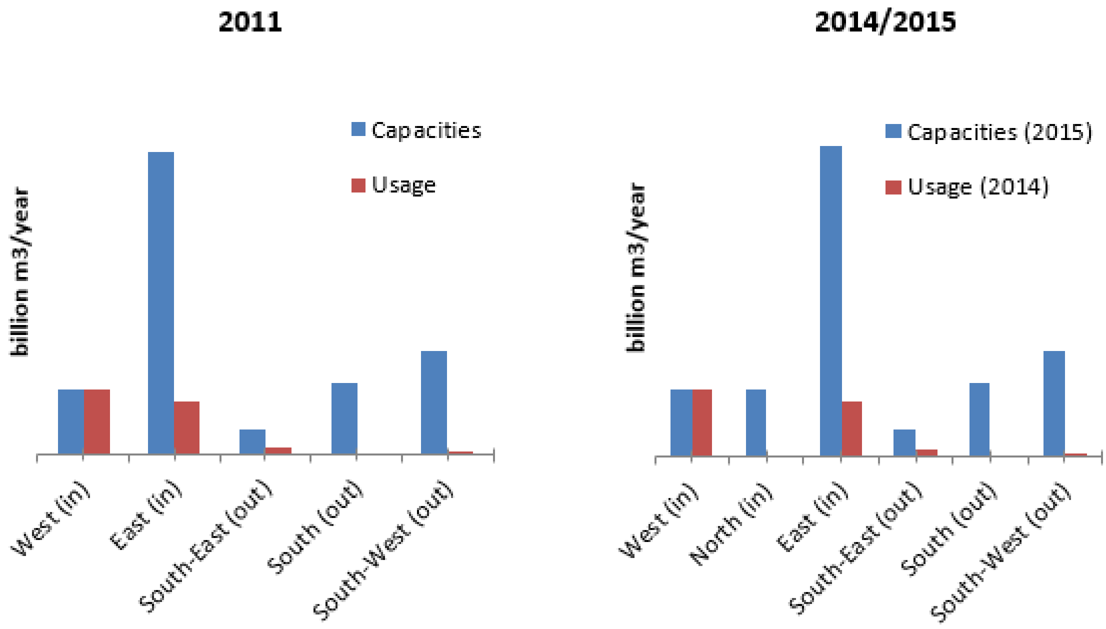
[222] Brüsszel bekötött a magyar energiaszabályozásba. Bruxinfo, 27.02.2015. http://bruxinfo.hu/cikk/20150224-brusszel-belekotott-a-magyar-energiaszabalyozasba.htm l

Southern exit point (towards Serbia)	13.2 million m^3/day (used only for transit)	13.2 million m^3/day
South-eastern bidirectional border crossing point (Romania)	4.8 million m^3/day	4.8 million m^3/day
Southern bidirectional border crossing point (Croatia):	19.1 million m^3/day	19.1 million m^3/day
Northern entry point (from Slovakia)	NA	12 million m^3/day
Northern exit point (to Slovakia)	NA	4,8 million m^3/day
Use of interconnection capacities for natural gas	**2011**	**2014**
Western entry point (from Austria):	4,4 billion m3	4,1 billion m3
Eastern entry point (from Ukraine):	3,6 billion m3	6,4 billion m3
Eastern exit point (to Ukraine)	NA	576 million m3
Southern exit point (towards Serbia)	13.2 million m3/day (used only for transit)	1,6 billion m3 OUT, no IN
South-eastern bidirectional border crossing point (Romania)	454 million m3 OUT, no IN	61 million m3 OUT, no IN
Southern bidirectional border crossing point (Croatia):	64 million m3 OUT, no IN	80 million m3 OUT, no IN
Northern entry and exit point (from/to Slovakia)	NA	0 m3
Additional data	2011	2014
Total gas consumption[223]	11,6 billion m3	8,5 billion m3
Peak consumption[224]	65,3 million m3/day	54,8 million m3/day in 2014

Sources: Annual reports of the Energy Office/MEKH (2011-2012, 2013, 2014), Statistical Data of the Hungarian Natural Gas System (2013, 2014) MEKH, Statistical Yearbook of Electricity, Natural Gas and District Heating 2011. Yearly reports of FGSZ (2011, 2012, 2013, 2014), FGSZ. Zrt. FGSZ public data from the downloads section

[223] Data in 15°C N m3
[224] Source of data: Hungarian Energy Office

Figure 23: Interconnection capacities and usage for natural gas in Hungary



With the recent capacity extensions, the maximum technical capacity of the gas system increased to 190 million m^3/day (incl. storage capacities), while the highest daily consumption was around 90 million m^3/day. Gas storage capacity recently increased to 6.2 billion m^3. Between 2010 and 2014, the overall natural gas demand in Hungary fell by 37 %, residential demand by 23 % and the gas demand of the power sector by 66 %. According to different forecasts, demand will further decrease due to higher efficiency in the residential and tertiary sectors. 80 % of the Hungarian gas demand is met by imported gas, originating exclusively from Russian sources. Domestic production is also expected to decline.

The level of security is high; however, the high reliance on Russian sources represents a supply security problem to a certain extent. A longer interruption in the Russian shipments to the CEE countries might still lead to serious disruptions, as the non-Russian capacities and cross border capacities are not sufficient to cover the demand of the region's 10-12 countries.

Wholesale gas market in Hungary and price evolution in the CEE region

Hungary does not have a physical gas hub. However, there is a virtual trading point: the Central Eastern European Gas Exchange Ltd (CEEGEX) which was established by the Hungarian Power Exchange Ltd. in 2013, though volumes traded are still very low.

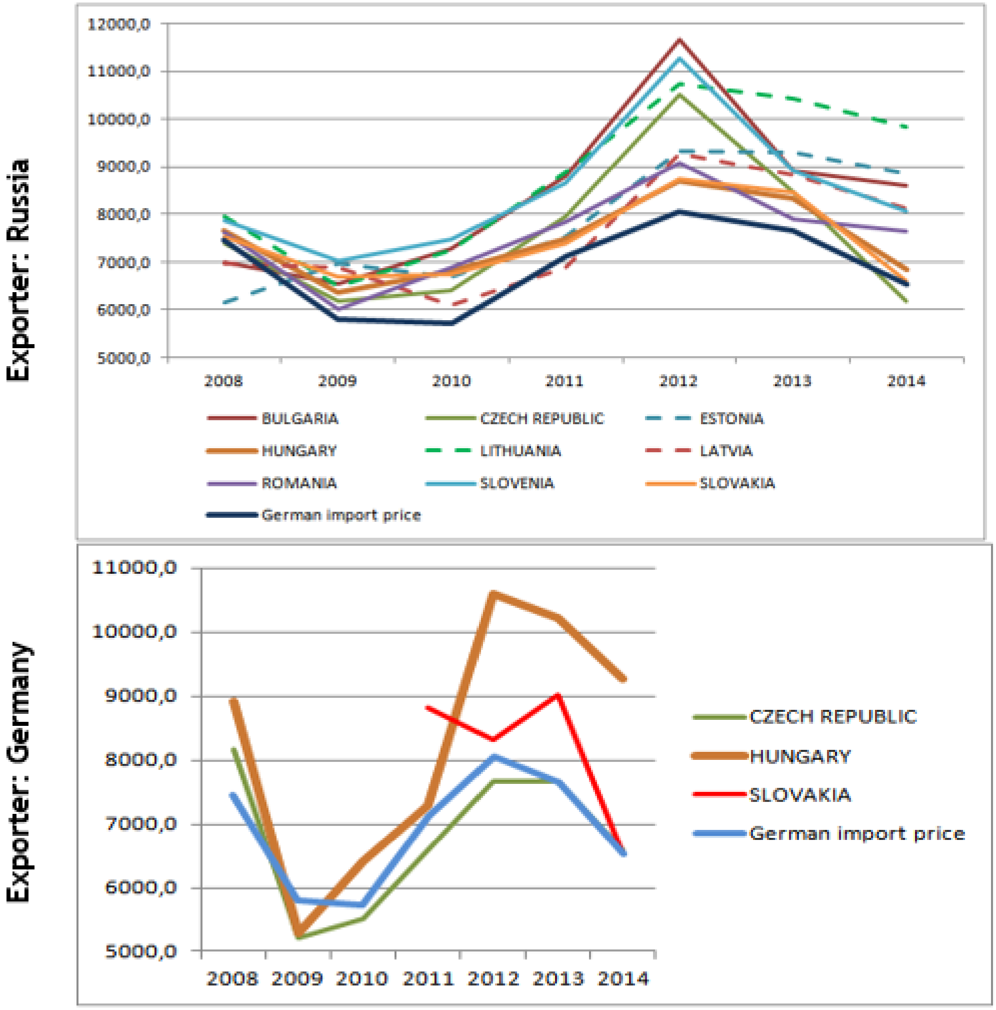
The liquidity of the Hungarian gas system has not been a problem - except when gas supply was limited due to gas disputes between Russia and Ukraine[225]. The Russian LTC offers liquidity to the Hungarian market by the regular renegotiations of min/max delivery quantities, and by using daily nominations and renominations. In 2015, the import capacities have been increased by the new entry point at the Slovakian-Hungarian border, while the demand is relatively low and decreasing.

[225] Gas import from Ukraine (Russia) was halted in January 2006 and in January 2009. A short interruption in gas supply took place in September 2014.

The progress towards a supranational integrated wholesale market is limited. The incumbent wholesaler has a dominant market position regarding gas imports: in 2014, 58 % of the imported gas was sold by Russian companies (versus 78 % in 2011), 34 % by Austrian companies (21 % in 2011) and the rest by French, Ukrainian and German companies.

Import gas prices in the CEE region raised steadily during 2008-2012, and the price divergence in the region increased as well. After 2012 they fell back and converged again to a large extent, except for Lithuania.

Figure 24: Cross-border gas prices. Prices: euro/TJ (GCV – Gross calorific value)[226]



The convergence of gas prices in the CEE region was the consequence of the developments in the gas market, i.e. the shift from LTCs to hub trading, as well as the fact that oil indexed prices were gradually (partly) substituted by gas-to-gas prices. Hungary has also renegotiated its LTC in 2013 and in 2015.

Political context

In 2010 the new government became hostile against multinational companies and started acquiring shares in energy companies. By now, the state has become the biggest stakeholder in the energy sector. Reducing residential gas prices has been high on the

[226] German border price is published by the Federal Office for Economic Affairs and Export Control (BAFA). It is the weighted average of all imported natural gas. Source: Eurostat

political agenda of the recent Hungarian governments. During 2013-2014, the regulations regarding residential energy prices were modified[227] by the government, in order to cut residential prices. This price intervention has led to an increase of non-household energy prices. In the gas market, the implementation of the second and third energy package was postponed as some provisions might have hindered reaching the government's policy goals.

Other geopolitical circumstances which are relevant in the context of this case study:

- Market based prices of natural gas available in the Austrian Gas Hub became lower than the oil indexed LTC prices in Hungary thus the demand for cheaper gas coming through the Western entry point grew significantly. This made the available capacity at the Austrian Baumgarten entry point scarce.
- The Austrian TSO did not extend cross-border capacities.
- The Take or Pay (ToP) clause in the Long Term Contract (LTC) with Russia forced the Hungarian wholesaler to purchase a predetermined quantity of natural gas, despite the significant decrease of the gas demand in Hungary.
- The liberalisation of the gas markets weakened the business opportunities of the incumbent wholesalers and traders.
- The Hungarian government has taken in decisions with a negative impact on international companies especially in the energy sector. The new regulations on electricity, gas and district heating prices, and the taxation of all energy companies decreased the suppliers' profitability.

Investments in gas infrastructure (pipelines, LNG terminal, storage)

The future development of the Hungarian natural gas infrastructure depends on the expected domestic demand, the Russian-Ukrainian political situation (and gas disputes), and ultimately the security of supply requirements of the EU. There are several projects which will improve Hungary's infrastructure:

- Hungary participates in the EU's 10-year gas infrastructure development program, as well as in the TESLA and EASTRING projects which should transport yearly 80 to 85 billion m^3 natural gas from the Caspian and Black Sea region to the South Eastern Europe. However, the Russian-Turkish conflict questions their viability.
- The long planned LNG terminal on the island Krk in Croatia should serve regional interests and diversification of sources. The project should be able to transport 6 billion m^3 of natural gas yearly to participating countries (including Hungary).
- Slovenian-Hungarian interconnection (1.3 billion m^3 per year) and Hungarian-Ukrainian pipeline (6.1 billion m^3 per year) are on the agenda.
- The Slovak-Hungarian pipeline installed in 2015 (which has not been used until now) could be extended towards Poland for resource expansion and diversification.

Storage capacities are another important element in the gas sector infrastructure. For a long period, Hungary had about 3.5 billion m^3 capacity. After the Russian-Ukrainian conflict, commercial storage capacity was extended to 6.2 billion m^3 capacity. Storage capacities and stored gas quantities comply with EU Regulation 994/2010 (e.g. the universal service companies are obliged to store 60 % of the heating season consumption of their residential clients) and with the N-1 requirement.

[227] The governing party had a majority of two thirds in the 2010 elections, therefore introduction or modification of regulations and laws was rather easy.

c. Political intervention in the Western interconnector capacity allocation

In April 2011, two ministerial decrees[228] were adopted which allocated 285 million m^3 gas from the strategic stocks to two gas wholesale companies (E.ON Földgáz Trade Zrt. and MVM Partner Zrt., a state-owned company) so that they could supply district heating companies at lower prices in order to reduce residential prices. At the same time, the decrees obliged them to replace the quantity used from the strategic stocks, and allowed them to reserve a yearly capacity (either Western or Eastern interconnection) for the whole year. This way, 398 million m^3 gas, and 2,9 billion m^3 gas transmission capacity (65 % of the total capacity of the Western pipeline) was offered to these two companies, without any auctions or tenders.

Moreover, in July 2011 the amendment of the gas act reduced the available capacity for interruptible shipments from 20 % to 10 % of the overall transmission network capacity. With the firm capacities of the LTC and the capacities newly allocated to the wholesalers, only 4 % of the Austrian entry point was still available for auctioning. The regulation set by the decrees was valid until July 2015 i.e. limitations on the Western transmission system were valid for four gas years (2011/12, 2012/13, 2013/14 and 2014/15).

The artificial bottleneck had a negative impact for the TSO (lower income from capacity auctions), the gas traders and the non-household consumers as the "cheap" gas was used to finance the price cuts in the residential sector. With this allocation mechanism traders and suppliers were obliged to buy gas from the two above mentioned wholesalers at higher prices.

At the same time, E.ON Trade and MVM did not fully use the capacity allocated to them – and other market actors could not use these capacities either, as they were not available (or only partly). In principle, unused capacity should be made available to other market parties according to the "Use it or lose it" rule in the EU regulation, but the third energy package was implemented only in 2015 in Hungary.

The TSO, FGSZ, offered monthly and daily capacities via auctions which generally were oversubscribed by 130-330 percent. The auction in 2012 was even oversubscribed six-fold[229].

E.ON and its successor avoided huge losses as gas-import prices and capacity allocations were politically influenced according to their interests. The other beneficiary MVM could not really gain with the decision; however, its import capacities were further transferred to another company (which is said to be close to governmental circles).

This political market intervention might have helped the LTC negotiations with Gazprom, as Hungary managed to reduce the "Take or pay" gas quantities, and the price indexation was also modified. This gave a relief for the state budget, as it could avoid paying for the losses of the gas business of MVM.

Due to the government's energy policy and general political (and economic) circumstances, several market actors left the market. According to information published by the energy authority[230], of the 56 companies that had a licence for gas trade, 18 left the market in recent years. This is an unfavourable phenomenon in terms of market integration, and competition.

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[228] Relevant laws: 13/2011 NFM and 15/2011 NFM and its modification at 02.03.20125 Modification of the Gas act.(XL/2008) at .01.07.2011
[229] The invitation to auction and the results of the auctions are available at the homepage of the TSO.
[230] http://www.mekh.hu/foldgaz-ipari-engedelyesek-listaja

According to market actors, the possible aim of the government was to prevent traders from importing gas at prices lower than those set by the LTC. The government apparently wanted to offer the incumbent wholesaler and the state owned gas trader an exclusive access to the cheaper gas. The government allegedly helped the wholesaler to sell the LTC-gas and precluded a decrease of the average import gas price for non-household consumers by offering the western import interconnection capacity to the two wholesalers. However, there aren't any hard proofs regarding the intentions of the government.

In any case, this way the incumbent wholesaler was saved from a significant loss (which the government would have had to refinance) as in March 2013 E.ON Földgáz Trade (the contracting party of the LTC) was taken over by state-owned MVM's Magyar Földgáz Zrt.

To what extent is this Hungarian political intervention in the gas sector conflicting with the EU legislation?

The government decisions were clearly not in line with the European regulation, in particular Directive 2009/73/EC and Regulations 1775/2005 and 715/2009/EC. The ministerial decrees contradicted competition rules as they differentiated between companies, grid access rules, and congestion management provisions.

Article 41 § 6 of Directive 2009/73/EC concerning common rules for the internal market in natural gas states that: "The regulatory authorities shall be responsible for fixing or approving sufficiently in advance of their entry into force at least the methodologies used to calculate or establish the terms and conditions for: (a) connection and access to national networks, including transmission and distribution tariffs, …(c) access to cross-border infrastructures, including the procedures for the allocation of capacity and congestion management."

As Regulation 1775/2005 does not define the exact method for capacity allocation and congestion management, regulators (and TSOs) could choose between different approaches. In Hungary, the bids for capacities were assigned in the order of arrival (First come first served). However, as the new Commercial Network Code in Hungary was approved only in November 2011, in reality no single auction was organised during the gas year 2010-2011.

Available network capacities for the Western pipeline were first auctioned in 2012, on the basis of the price offered (pay-as-bid). As of July 2015 capacities are traded on the Regional Booking Platform[231].

The ministerial decrees adopted in 2011, determined the method for capacity allocation and congestion management without intervention of a regulatory authority, and were hence not compliant with the 2009/73/EC Directive as well as Regulation 1775/2005. The EC called several times for an independent regulatory authority in its yearly "Country Reports". "Key parameters for calculating network tariffs are set by the Ministry and seriously limit the NRA's ability to set network tariffs autonomously... In addition, appeal procedures appear to be unsuited to ensure that regulatory decisions can be challenged effectively. The independence of the national regulatory authority should be strengthened."[232] Similar opinions were reflected in the yearly evaluations on the single energy market.[233]

The 13/2011 ministerial decree violated Article 41 paragraph 6. (c) of the 2009/73/EC Directive, as the Regulatory Authority should regulate the access to the networks and

[231] An electronic auction and capacity trading platform developed on the basis of Regulation 984/2013/EU (CAM NC) and additional associated requirements of the European gas market

[232] https://ec.europa.eu/energy/sites/ener/files/documents/2014_countryreports_hungary.pdf page 1.

[233] https://ec.europa.eu/energy/sites/ener/files/documents/20121217_energy_market_2011_lr_en.pdf

determine congestion methods as cited above. It also violated the requirement set by the third party access regulation (Article 32 paragraph 1 of the 2009/73/EC Directive): “without discrimination between system users”.

Finally the ministerial decree violated Article 14 Paragraph 1a of the Regulation 715/2009/EC on conditions for access to the natural gas transmission networks which states: “1. Transmission system operators shall: (a) ensure that they offer services on a non-discriminatory basis to all network users”. Moreover the same Regulation prescribes in Article 16 paragraph 1 and 2: ”1. The maximum capacity at all relevant points ... shall be made available to market participants, taking into account system integrity and efficient network operation. 2. The transmission system operator shall implement and publish non-discriminatory and transparent capacity-allocation mechanism…”.

What efforts are needed to remove obstacles to ensure a well-functioning interconnected cross-border gas market in Hungary?

After the implementation of the third energy package in the gas market in 2015, the Hungarian government withdrew the ministerial decrees in question. The new capacity booking method and the full implementation of 715/2009/EU regulation will in principle make it more difficult for national politicians to create artificial bottlenecks in the gas supply chain in order to support real or perceived interests of specific market actors.

The LTC price level and that of hubs converged in Hungary and other EU countries. Russia gradually reduced the strong price differentiation among countries leading to less incentive for gas traders to participate in the auctions of available capacities at the Austrian entry point, as auctions also increased the gas price. Thanks to the development of gas hubs in the EU and the gradual review of LTCs, most gas supply contracts are now closer to the EFET-type contracts which are standardised and fulfil all regulation requirements for energy trade.

Decision making at the EC level is slow. Decisions in infringement procedures against MSs lag behind and legal procedures and penalties – if any - are not rapidly implemented. Thus MSs can implement decisions that conflict with EU legislation for a long time.

d. Analysis

Key findings and concluding remarks

The Hungarian regulation introduced in 2011 contradicted the EU regulation. It hurt the rights of gas trading companies and was discriminatory. It would be difficult to calculate the balance of losses and gains; however, the regulation resulted in a higher gas price for professional end users (companies) compared to a situation with market based import capacity allocation (auctions). The most significant finding is that Hungary could preserve this non-compliant regulation for about 4 years and that the EC did not formally force the Hungarian government to withdraw or amend it, notwithstanding the reactions from several market parties.

What were the main reasons for not correctly implementing the EU regulations on allocation?

Political interests in the first place prevented the correct and timely implementation of the EU regulations. Another important factor was the existence of the LTC: the take-or-pay clause and oil price indexation caused a significant burden to the Hungarian economy, compared to countries where LTCs have less impact. Hungary and other Eastern European countries are struggling to ensure their gas supply and at the same time reduce their

energy dependence. Hungary did not start an arbitration procedure against Gazprom as for example Poland did. Finally, gas consumers have very little knowledge on gas markets including prices, therefore retailers are in a comfortable position. The complex pricing method is a dark secret for the consumers and responsibility lies with the Energy Office.

To what extent did this national market intervention hinder cross-border market integration and price convergence?

This Hungarian regulation has hindered the access to (cheaper) western gas resources for gas traders and consumers in 2011-12. As a direct result, non-household gas prices increased. Further, it made it difficult for foreign companies to stay in the Hungarian gas market. As of 2013, the overall gas demand and the demand for western gas diminished, also due to the lower prices of the renegotiated LTC. Therefore there was interconnection capacity available which was auctioned by the TSO on monthly and daily basis; some traders booked part of this offered grid access but had to pay a surcharge. Auction prices were high in some months of 2011-2013 too, but in the second half of 2013 the physical capacity of the Western entry point was utilised only to 75-95 %.[234] Therefore TSO auctions in that period were not very successful; all offered capacity was not effectively booked.

The present situation shows that there is no interest in importing gas from western markets as the new Slovak-Hungarian interconnection is unused – although the Central European Gas Hub in Austria, or other trading point(s) could be reached through it. Moreover, there is hardly any trade on the Hungarian gas exchange (CEEGEX). It is a situation where the final consumers (mainly the non-household consumers) are in a losing situation and only some of the gas trading companies win. We need some time to see whether the new regulation on capacity allocation will render the gas trade sector in Hungary more liquid and dynamic.

Are there unforeseen consequences of the introduction of the EU regulation for the region?

It is an unforeseen consequence that there is no trade at the Slovak-Hungarian interconnection. The capacities of the western interconnecting point are mostly firm and 88 % of them were booked (but not necessarily used). Until September 2016, 98 % of the firm capacities are booked. For the following years, only 20 % of the firm capacities are booked, but yearly and quarterly auctions are planned. However, effective nominations are rare (though only a short time has passed since the start of the new booking platform).

e. Key lessons learnt

National infringements of EU legislation should be more rapidly and effectively addressed at EU level

The most important finding is that a national government can take and maintain measures that violate EU regulation during several years, without penalty or formal public intervention from the European Commission. In Hungary, there are few opportunities for market parties to seek justice: Governmental, ministerial decrees or regulations of the Hungarian Energy Office (the Regulatory Authority) cannot be challenged at courts.

National authorities should be more rapidly forced to withdraw any national legislation that is not compliant with EU rules. The work of EU institutions should be accelerated and intensified, especially if the violation of EU regulation is evident and company complaints

[234] http://rekk.hu/downloads/publications/REKK_report_2014_Q2.pdf
http://rekk.hu/downloads/publications/REKK_report_2014_Q3.pdf

are known. In several countries, in particular Hungary, EU investigations and infringement procedures with court decision are the only and ultimate way for enforcing compliance.

The newly introduced Regulation on Energy Market Integrity and Transparency (REMIT) can contribute to avoid market distortions, as every new wholesale contract and related price, volumes etc. should be reported, and the competent regulatory authority will collect and analyse all wholesale market data. Based on these data, market abuse can be easily tracked. However, as REMIT is still in its implementation phase it is too early to assess whether it will ensure greater transparency and contribute to reduce the risk of market manipulation.

Can gas hubs efficiently support the internal gas market completion?

Both physical and virtual gas hubs are important instruments for developing liquid gas markets and they contribute to trade natural gas as an ordinary commodity. There are currently many gas hubs in Europe, but only few in Eastern EU. There are certainly important preconditions to establish and operate a gas hub, but it is the most effective way to have transparent trade especially for countries where gas consumption is limited. A gas hub or trading point where the Russian gas import reaches the CEE region would be favourable.

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DIRECTORATE-GENERAL FOR INTERNAL POLICIES

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