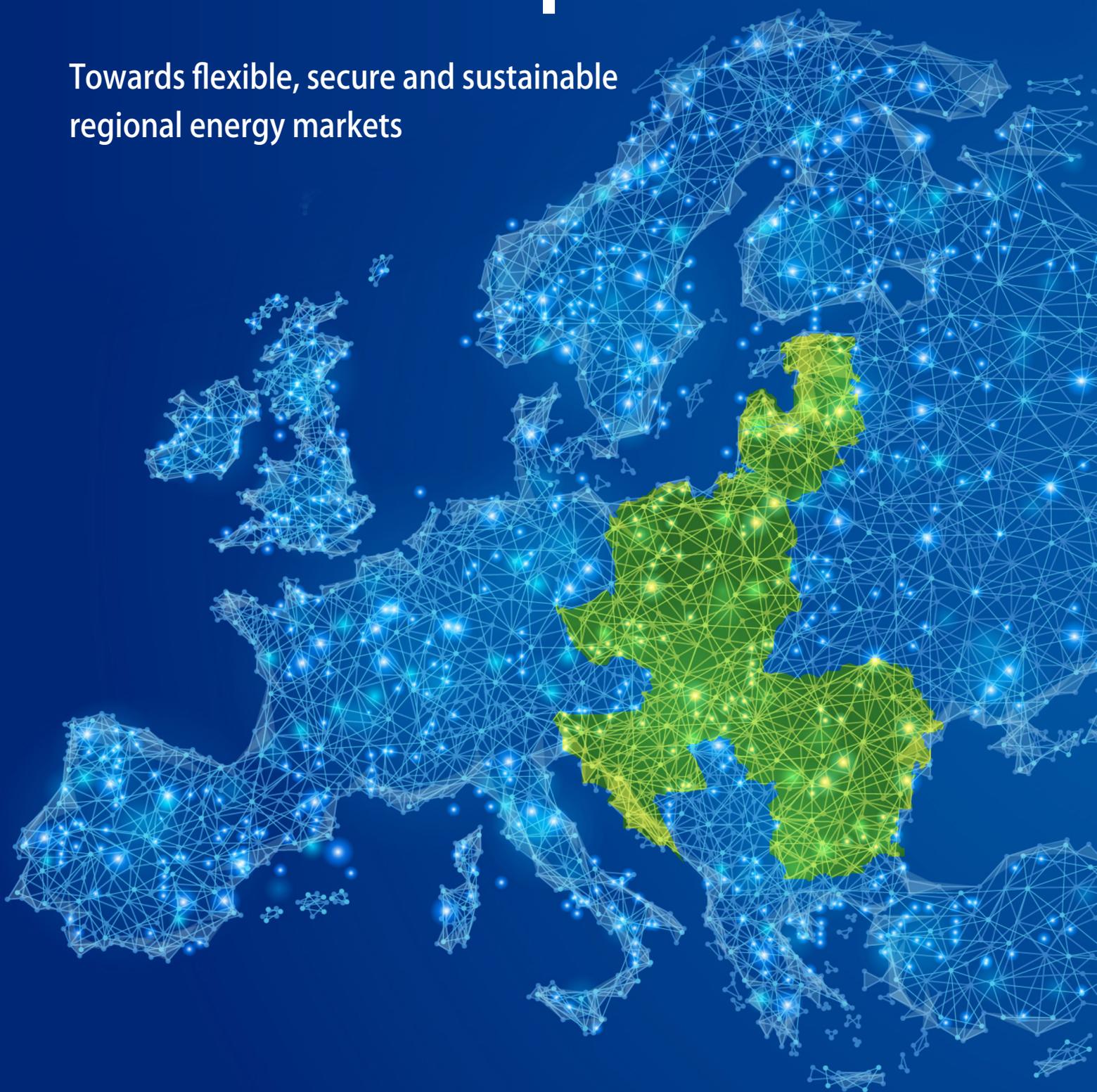


Cross-border energy cooperation in Central Europe



Towards flexible, secure and sustainable
regional energy markets



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Towards flexible, secure and sustainable regional energy markets

INTRODUCTION

Regional cooperation has become one of the genuine pillars of European energy policy. It is pursued in all five dimensions of the Energy Union: security of energy supply, internal energy market, energy efficiency, climate policy and research and development. Preventive and emergency plans for an energy crisis, coordination and data exchange on power flows, regional action plans for interconnections, deployment of cross-border smart grids or joint renewables projects or support schemes – they are all different manifestations of the regional approach in building Energy Union.

Central Europe is also a party to this regionalization trend. In recent years countries in Central Europe have engaged in numerous cooperation projects. As a result, the region is becoming increasingly interconnected, integrated and resilient. The Central European states have developed numerous initiatives, which further enhanced functioning of energy systems in particular states. The main aim of these efforts has been to take care of the development of the gas and electricity sectors both in terms of infrastructure and liquidity of the markets. They surpassed cooperation limited merely to hard infrastructure development (mostly related to gas sector) and currently, they increasingly focus on market integration and reliable functioning of the electricity sector and energy related innovations. This is a big qualitative change that proves increasing maturity and durability of cooperation in Central Europe. It is worth noting that effectiveness of the implementation of the European acquis on a national level depends on its synergies with particular objectives of certain member states. In the case of cross-border energy cooperation, Central Europe provides several examples of such synergies.

This analytical paper is based on contributions of CEEP's partner institutions: Romania Energy Center, Sobieski Institute (PL), Slovak Foreign Policy Association, Center for Study of Democracy (BG), Institute for Development and International Relations (HR), Foundation for Regional Policy Cooperation in Energy and Infrastructure – REKK (HU), Vytautas Magnus University (LT), Center for energy Studies – Masaryk University (CZ). Its aim is to present a broad picture of the regional energy cooperation in Central Europe. First, we present different fora for facilitating cooperation both vertically and horizontally. Secondly, we review the main achievements of regional cooperation in gas and electricity sectors that stem from a natural belief that infrastructure development is a necessary prerequisite to market integration and increasing security of supply. Another element of our inquiry is research and development where numerous specific projects are analysed. The article concludes with recommendations on how to further strengthen regional cooperation within Central Europe and how to integrate the region within the context of the broader European energy market.

INSTITUTIONAL FORUMS OF REGIONAL COOPERATION

TOP-DOWN DIMENSION OF THE REGIONAL COOPERATION

The European Union is actively supporting energy projects that are particularly relevant to cooperation plans between the Member States. Regional cooperation is seen as an important building block of the Energy Union and a viable way of countering cases of supply interruptions in the future by means of increasing market liquidity and interconnectedness. Furthermore joint actions can bring greater benefits to the EU economy and strengthen relations between its participants. The driving player in this process is the European Commission, which can provide essential elements of coordination and financial support.

The EU financial instruments, namely European Energy Programme for Recovery (EEPR), European Regional Development Fund (ERDF) and Connecting Europe Facility (CEF) that is guided by Projects of Common Interest (PCI) lists, do have a critical role to play in this context. They facilitate numerous - mainly infrastructure - projects and help to tip the overall balance for the projects which would not be feasible based on economic considerations alone.

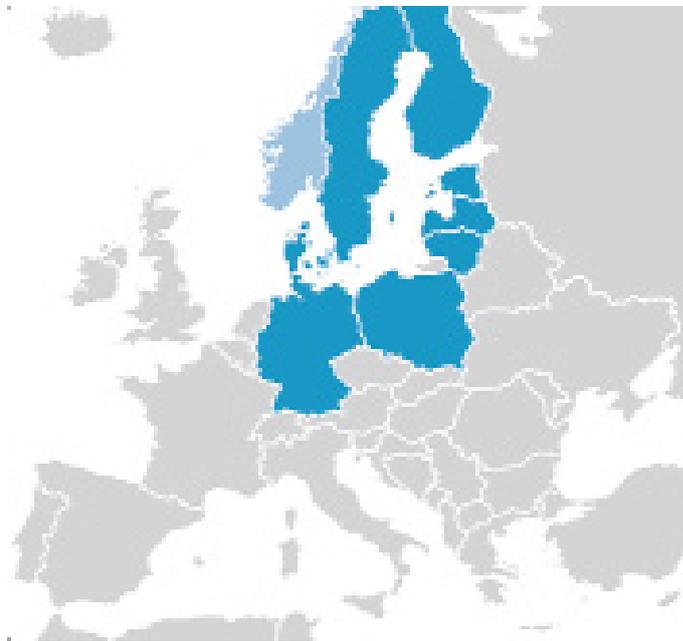
HIGH LEVEL GROUPS IN ENERGY SECTORS

High Level Groups bring together representatives from EU countries in the region, transmission system operators, and regulators. They provide a political platform helpful for strategic steering and policy guidance on technical topics. Their proceedings are facilitated by the EC, DG Energy. For energy cooperation in Central Europe, two groups are of paramount importance: Baltic Energy Market Interconnection Plan (BEMIP) and Central and South Eastern Europe Energy Connectivity (CESEC).

BEMIP was established in 2009 and includes Denmark, Germany, Estonia, Latvia, Lithuania, Poland, Finland, and Sweden, facilitated by the European Commission. The goal of the BEMIP is to achieve open and integrated regional electricity and gas markets between EU countries in the Baltic Sea region, inter alia to end the energy isolation of the Baltic States. A number of cross-border and domestic infrastructure projects have been completed across the Baltic States to further develop their electricity markets. The completion of key electricity infrastructure projects such as Estlink,

Nordbalt and LitPol Link (connecting the Baltic States with Finland, Sweden and Poland) significantly improved the Baltic countries' integration in the EU energy market and their security of supply. They are now among the best electricity inter-connected countries in Europe.

Map 1. BEMIP



Source: European Commission, Infrastructure Transparency Platform

The flagship projects carried out under the BEMIP umbrella are the synchronization of the Baltic power grids with the EU. After several years' debates among the Baltic States, PSE, the Polish TSO, on request of the Baltic TSOs, submitted an application to the European Network of Transmission System Operators (ENTSO-E) for the extension of the Continental Europe Synchronous Area. In October 2018, Lithuania's Litgrid, Latvia's AST and Estonia's Elering submitted an application to CEF for €432 million in funding for the project's first stage. The expected deadline for completion of the synchronization of the Baltic power grid with the continental European network is 2025, and it will be carried out through alternating current (AC) LitPol Link between Lithuania and Poland and direct current (DC) submarine cable between these countries. In order to ensure energy security, other stabilization mechanisms, such as synchronization compensators will be employed. The total estimated cost of the project is between 770-960 million EUR, 75% of which is expected to be covered by the EU.

To further implement the goals set out in the BEMIP, the Polish TSO, GAZ-SYSTEM, together with the Lithuanian TSO Amber-Grid, currently work on Gas Interconnector Poland – Lithuania (GIPL). The project includes construction of over 500 km

of gas pipelines. Once completed in 2021, it will end the gas isolation of Baltic States and allow a significant increase in the gas trade between Poland and Lithuania. With respect to Poland, the BEMIP also assumes construction of a gas pipeline extension of the LNG terminal in Świnoujście and extension of entry points to the Yamal pipeline in Lwówek and Włocławek – Gustorzyn node.

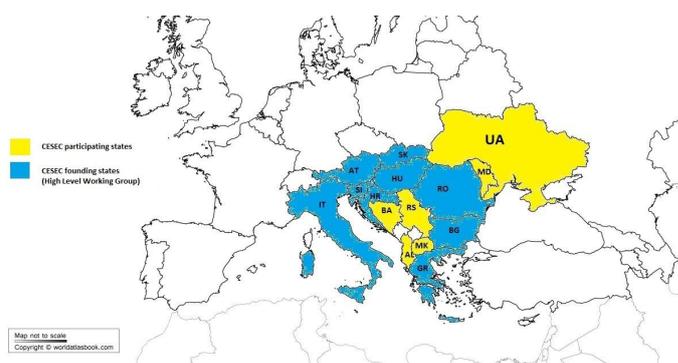
Map 2. Main investments in the transmission system in Poland



Source: Gaz System, Development Plan 2014-2023

CESEC was launched by governments of Austria, Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovakia and Slovenia in 2015, with the support of the European Commission. It was further extended by the Energy Community Secretariat and its contracting parties to include Serbia, Macedonia, Albania, Bosnia and Herzegovina, Montenegro, Ukraine and Moldova. The main goal of this format is to ensure gas source diversification and security of supply in Central and South Eastern Europe. CESEC is a tool for debating cooperation and monitoring the implementation process of the priority projects. In 2017 it was decided to extend the cooperation within the group to the electricity sector and energy efficiency.

Map 3. CESEC



Source: Romania Business Journal

LIST OF PROJECTS OF COMMON INTEREST (PCIs) AND CONNECTING EUROPE FACILITY (CEF)

Projects of common interest are key cross-border infrastructure projects that link the energy systems of EU countries. Selected projects have significant impacts on energy markets and market integration in at least two Member States. The status of a PCI allows a project promoter to apply for financial support from Connecting Europe Facility Instrument, which has a budget of 5.85 billion EUR between 2014 and 2020. CEF is a key EU funding instrument for connecting the markets through targeted infrastructure investments. PCIs have proven to be an important and viable tool used to support development of the integrated EU-wide energy market.

The selection process of the PCIs is conducted within pre-identified Trans-European Networks for Energy (TEN-E) strategy regional groupings – infrastructure corridors. There are four corridors concerning the electricity sector, four dedicated to the gas sector, one for the oil sector, and three thematic groups. Central European states participate in: North-south electricity interconnections in Central Eastern and South Eastern Europe, the Baltic Energy Market Interconnection Plan in electricity, North-south gas interconnections in Central Eastern and South Eastern Europe, Southern Gas Corridor, the Baltic Energy Market Interconnection Plan in gas, and oil supply connections in CEE. Investments in infrastructure of pre-identified corridors are crucial for development of a well-connected and integrated internal energy market. PCI eligible projects have to be enlisted in ten-year network development plans (TYNDP) and have cross-border effect.

In November 2017 the Commission published the third list of PCI projects (updated every two

years) which includes: 106 electricity transmission and storage projects, 4 smart grid deployment projects, 53 gas projects, 6 oil projects and 4 cross-border carbon dioxide networks.

Central European countries have been very successful in using the CEF financial support – currently approximately 80 projects have already received support from the CEF. It proves the outstanding absorption potential of CEE to witness the multitude of projects that are being developed in the region.

Table 1: PCI projects from Central Europe included in the Third PCI List

Country	Numbers of PCI Projects
Bulgaria	5 in Electricity, 5 in Gas
Poland	4 in Electricity, 10 in Gas, 3 in Oil
Hungary	2 in Electricity, 6 in Gas
Latvia	4 in Electricity, 2 in Gas
Lithuania	3 in Electricity, 2 in Gas
Estonia	8 in Electricity, 2 in Gas
Slovakia	2 in Electricity, 4 in gas, 1 in Oil, 1 in Grids Deployment
Czech Republic	5 in Electricity, 3 in gas, 1 in Grids Deployment, 1 in Oil
Slovenia	1 in Electricity, 4 in Gas, 1 Smart Grid
Romania	6 in Electricity, 6 in Gas
Croatia	5 in Gas, 1 in Grids Deployment

Source: European Commission, Third PCI List

SECURITY OF GAS SUPPLY MECHANISMS

Amended Security of Gas Supply Regulation (2017/1938) requires EU countries to cooperate with each other in regional risk groups to carry out common Risk Assessments and to develop and agree on joint preventive and emergency measures (to be reflected in their national Preventive Action Plans and Emergency Plans)¹. The new regulation also requires that in the event of a regional emergency, the TSOs should cooperate and exchange information using the ReCo (Regional

¹ Within legislative works on this file, the EU MS decided to replace the initial EC idea of cooperation in a fixed regional group with the risk groups depending on possible supply risks. Central European MS are in several different groups: Eastern gas supply risk groups:

(a) Ukraine: Bulgaria, Czech Republic, Germany, Greece, Croatia, Italy, Luxembourg, Hungary, Austria, Poland, Romania, Slovenia, Slovakia;

(b) Belarus: Belgium, Czech Republic, Germany, Estonia, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Slovakia;

(c) Baltic Sea: Belgium, Czech Republic, Denmark, Germany, France, Luxembourg, Netherlands, Austria, Slovakia, Sweden;

(d) North-Eastern: Estonia, Latvia, Lithuania, Finland;

(e) Trans-Balkan: Bulgaria, Greece, Romania

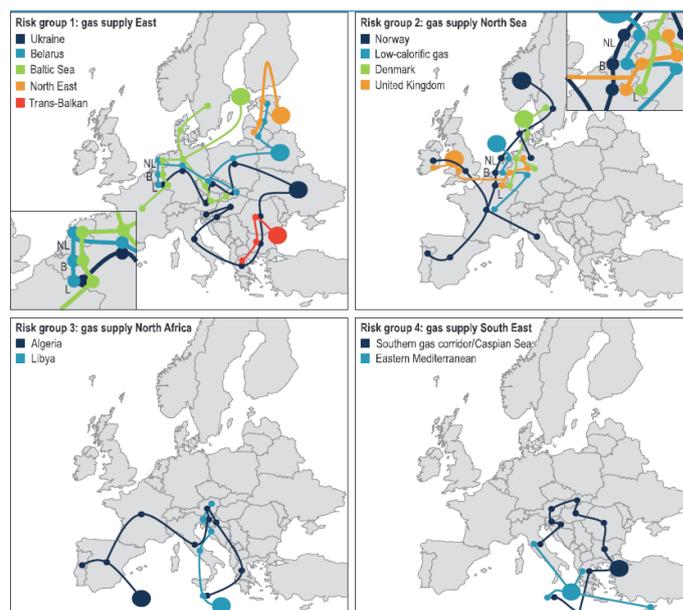
South East Gas Supply risk group:

a) Southern gas corridor— Caspian: Bulgaria, Greece, Croatia, Italy, Hungary, Malta, Austria, Romania, Slovenia, Slovakia;

Cooperation) System for gas established by ENTSO-G. Europe is split into four regions.

Cooperation between parties worked several times. For example, during the cold spell in February 2017, the members of ReCo Teams East and North-West met to plan and exchange information. In December 2017, the ReCo Team East held two virtual meetings due to the incident at the Baumgarten hub in Austria that caused disruption of gas flows from Slovakia to Austria, and from Austria to Hungary, Italy, Slovenia and Croatia.

Map 4. Risk Group envisaged in the Gas Supply Regulation (2017/1938)



Source: IEA, Global Gas Security Review 2017

EUROPEAN NETWORK OF TRANSMISSION SYSTEM OPERATORS - ELECTRICITY AND GAS

A key role for facilitating regional cooperation has been filled by ENTSO-E and ENTSO-G, associations of the European transmission system operators for electricity and gas, respectively. These institutions provide a forum for horizontal cooperation by the respective TSOs. Hence, both associations actively cooperate on the development of the EU-wide network planning, by means of, in-

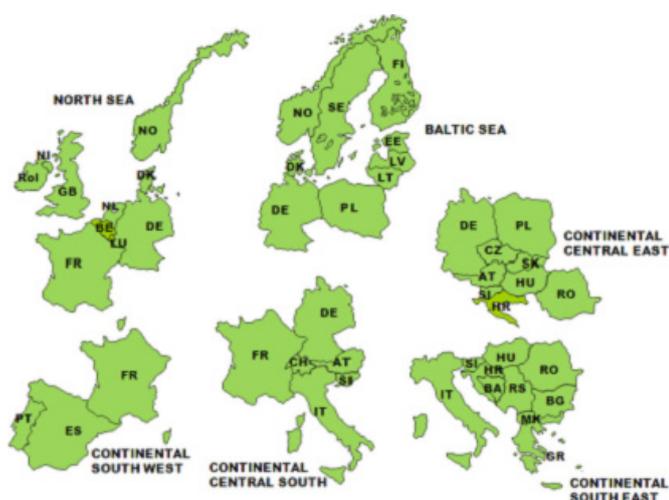
ter alia, the ten-year network development plans (TYNDP) and regional investment plans. Investment included within TYNDP may apply to receive the status of a PCI. The role played by these entities is indispensable for advancing market integration, solving every day operational and security issues and facilitating regional cooperation.

In the case of gas, Development of Gas Regional Investment Plans (GRIP) within ENTSO-G requires coordination among national TSOs within regional groups. Central European states are included in Central Eastern Europe, coordinated by 2 TSOs: BOG (AT) and GAZ-SYSTEM (PL), BEMIP – coordinated by Amber Grid (LT) and Southern gas corridor. Overall the role of

ENTSO-G is to facilitate and enhance cooperation among national gas TSOs across Europe in order to ensure the development of a pan-European transmission system.

With regard to the electricity market, ENTSO-E developed Regional groups based on synchronous areas, which ensure compatibility between system operations on the one side and market solutions and system development on the other. Moreover, they address technical and operational aspects which include: enhancing and developing operational processes; investigation of frequency deviations; enhancement and maintaining of network models, compliance monitoring and enforcement, and integrating internal and interconnecting external systems².

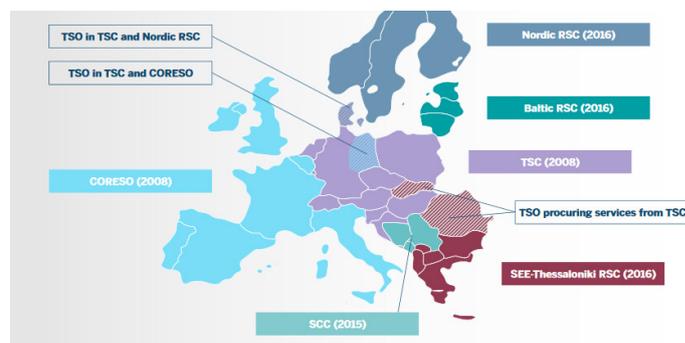
Map 5: ENTSO-E Regions



Source: ENTSO-E

Furthermore, within the ENTSO-E, Regional Security Coordination (RSC), entities have been launched for contingency information sharing and power flow management. TSOs operate the power grids in real time, supported in this respect by information and strategies provided by the RSCs. Starting from 2016, participation in RSC became mandatory.

Map 6. Expected structure of the 6 electricity RSCs by end of 2017



Source: FTI-CL report for Entso-E

ACER

The Agency for the Cooperation of Energy Regulators plays also an important role in promoting regional cooperation. Within ACER have been developed Regional Initiatives framing cooperation among the National Regulatory Authorities, or energy regulators (NRAs), transmission system operators, the European Commission, national governments, and energy companies. The purpose of this format is to spur capacity allocation mechanisms, infrastructure development and contribute to market integration. Central European MS are included in the South South-East Gas Regional Initiative. Work in this format is co-chaired by Serbian regulator AERS and Czech ERU.

BOTTOM-UP DIMENSION OF REGIONAL COOPERATION

Energy has become an important and recurring subject of horizontal cooperation among Central European EU member states. In this regard, they share similar perceptions of the vulnerabilities of their energy systems mostly related to underdeveloped infrastructure and lack of systemic interconnections along the North – South axis. The examples discussed above prove that Central European states were able to develop durable regional formats, identify key projects and to find ways to implement them. Furthermore, they were able to use EU financial resources and to gain support

² Katharina Umpfenbach, Andreas Graf, Camilla Bausch, "Regional cooperation in the context of the new 2030 energy governance", Ecologic Institute, January 30, 2015, p.10-11.

from the EU for key initiatives.

VISEGRAD GROUP

The longest, but also the most developed and important regional cooperation in Central Europe is the Visegrad group. Energy has been for a long time an important cross-sectional topic for the Czech Republic, Hungary, Poland and Slovakia with the North–South energy corridor being one of the main priorities of the group not only in the energy area, but also in transportation and telecommunications. Energy security (and diversification of sources of energy supplies as its crucial component) is considered to be a long-term priority of the group. The program of the current Slovak V4 presidency for 2018 – 2019 defines energy security as one of the strategic priorities of the V4 countries with regard to their common high dependence on the import of energy sources from third countries³.

The cooperation of Visegrad countries touches upon various areas related to energy policy and engages further in developing a common approach towards the EU legislation proposals. The program of the current Slovak V4 presidency, for example, calls for promotion of projects strengthening energy security and closer cooperation in the renewables sector and stresses the importance of North-South energy corridor completion in the natural gas sector. It also defines electricity loop flows as the main obstacle to further development of the electricity market in Central and Eastern Europe, and identifies nuclear energy as the crucial tool for achieving EU's greenhouse gas emissions goals⁴. The cooperation of Visegrad countries encompasses regular coordination negotiations before formal and informal Councils at the level of ministers or state secretaries, energy working groups or workshops at the expert level.

A big step forward was achieved in 2016 when the Permanent Forum of Energy Regulators was established. Within this format, in 2017, two meetings of the Visegrad countries' regulators took place. In addition, V4 countries regularly hold international conferences on energy security and gas supply, have a functioning expert working group on energy and have recently launched their energy think tank platform, supported by the International Visegrad Fund.

BALTIC SINGLE GAS MARKET

The prime ministers of Baltic countries signed a declaration on creating a single, regional natural gas market on 9th December 2016. This document states that the Regional Gas Market Coordination Group (RGMCG), consisting of relevant ministries, regulators, and operators of the gas infrastructure of regional importance, will prepare market rules that market participants will follow.

These rules require: access to the network, properly addressing balancing and trading should be properly addressed, ensuring coordinated joint balancing zone with an efficient capacity allocation mechanism, a properly functioning market area, a convenient virtual trading hub and regional gas market. An entry-exit system with a common gas transmission tariff regime also should be created, complemented with an effective inter-transmission system compensation mechanism. Another benefit of the single regional market in the Baltics is that it will secure an improved access to Klaipeda LNG terminal and other alternative sources of gas supply to every country in the region.

A milestone for the integration process was the establishment of an implicit capacity allocation model with Latvia's Conexus, Lithuania's Amber Grid and Estonia's Elering in July, 2017. In 2018, a memorandum between Estonia and Latvia for commitment towards the Baltic single Gas Market was agreed upon, and this was a step toward enabling adoption of the necessary legislative amendments in national legislations and ensuring that single regional gas market becomes operational in 2020.

THREE SEAS INITIATIVE

The purpose of the Three Seas Initiative (3SI) is to introduce new high-level platform of regional cooperation and increase coherence of the loosely economically and politically related region of Central Europe. This goal is translated into development of energy, transport and digital infrastructure corridors among countries, thereby increasing the interconnectivity of the entire region stretching from Estonia in the North, to Croatia and Bulgaria in the South.

Concerning energy, the 3SI is to provide high-level political backing in order to implement key infrastructure projects. The 3SI could be a suitable platform for creating an economically stronger re-

³ <http://www.visegradgroup.eu/documents/presidency-programs>

⁴ <http://www.visegradgroup.eu/documents/presidency-programs>

gion. During the Bucharest Summit in September 2018, heads of state adopted a list of priority projects including⁵:

Priority multilateral projects in the energy field:

- Gas Interconnector Poland - Lithuania (GIPL)
- Bulgaria - Romania - Hungary - Austria pipeline (BRUA)
- Slovakia - Hungary - Romania - Bulgaria pipeline (Eastring)
- Integration and synchronisation of the Baltic States' electricity system with continental European networks
- Romanian-Hungarian-Slovak gas transmission corridor
- Diversification of gas supply sources and integration of gas infrastructure in the Three Seas Region with the implementation of the Baltic Pipe project and cross-border interconnections between Poland-Slovakia and Poland-Ukraine
- Ionic Adriatic Pipeline (IAP)
- LNG Terminal on the Island of Krk with evacuation pipeline

Bilateral and national projects with international potential:

- Hungary-Slovenia gas interconnector
- Smart grid project implemented by Croatia and Slovenia: SINCRO.GRID
- Commissioning of the regional LNG terminal in Paldiski, Estonia
- Construction of the 500MW Estonian hydro pumped storage
- "Compressor station 1" at the Croatian gas transmission system
- Purchase of the Floating Storage Regasification Unit Independence (Klaipeda LNG)

Furthermore, an important step was undertaken to develop the initiative and secure financing through the Three Seas Fund, which would be created by the development banks of six countries: Croatia, Czech Republic, Latvia, Poland, Romania and Slovakia with initial capital of up to €5 billion.

REGIONAL COOPERATION WITHIN GAS SECTOR

INFRASTRUCTURE DEVELOPMENT

The Russian-Ukrainian gas conflict in 2009 highlighted infrastructure vulnerabilities of Central European states and their dependency on their main supplier. Development of systemic interconnection became the paradigm for regional cooperation in the following years. Currently, with many projects completed or underway, Central European states have shifted their focus to physical diversification of supply possible thanks to projects such as LNG terminals or pipelines opening access to alternative sources of supply: Baltic Pipe, BRUA pipeline, Gas Interconnector Greece – Bulgaria (IGB).

For guaranteeing the security of gas supply, the system development planning process has key importance. Prepared by the TSO and DSO, the development plan with the scope of satisfying the current and future demand for gas, includes in particular the anticipated extent of gas supply, projects related to modernization, expansion or construction of the network and planned new sources of gas, as well as modernization and extension projects or building connections with gas systems of other countries. To guarantee the coherence of such planning, ENTSO-G supports jointly developed TYNDP, which contribute to increased interconnectivity within the EU. To help prevent potential supply disruptions, EU legislation creates common standards and indicators to measure serious threats and define how much gas EU countries need to be able to supply to households and other vulnerable consumers.

In this context, an ambitious plan for the construction of the North-South Gas Corridor - a set of interrelated gas transmission infrastructure projects that connect Central and Eastern European markets from the Baltic to the Adriatic and the Black Seas - is particularly important⁶. Its implementation requires the cooperation of public administrations, national regulatory agencies and private undertakings. North-South Gas Corridor itself was also recognized at the EU level. It has become one of the priority gas corridors within the Trans-European Network for Energy (TEN-E) strategy.

Its key elements are LNG terminal in Świnouj-

⁵ <http://three-seas.eu/three-seas-initiative-short-list-of-priority-interconnection-projects/>

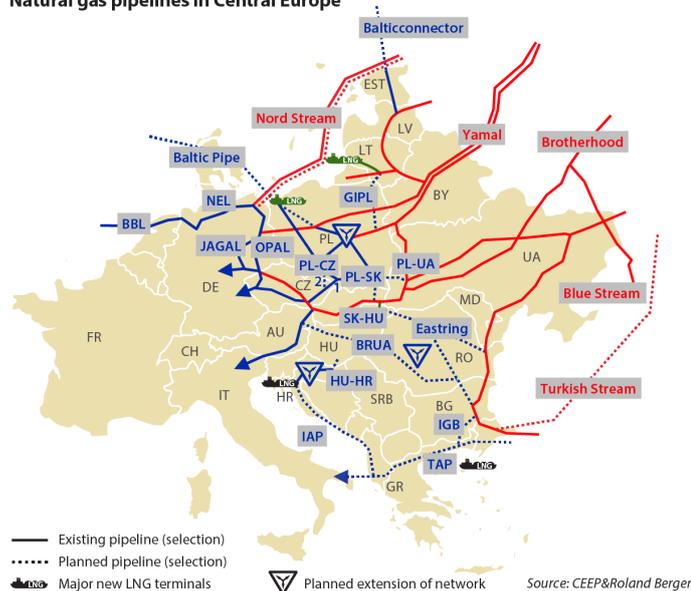
⁶ CEEP together with Atlantic Council have been one of the initiators of this concept: https://www.ceep.be/www/wp-content/uploads/2014/11/Completing-Europe_Report.pdf

ście with 5 bcm capacity, operational since 2016. Planned expansion of the terminal up to 7.5 bcm by the end 2022 obtained the PCI status. Another terminal on the Baltic Sea - LNG Terminal Independence in Klaipeda was launched in 2015.

The LNG terminal to be located on the Croatian island of Krk, which is scheduled to be operational in 2020, has also been included on the PCI list from 2013 and on Croatia's list of projects for strategic investment since 2015. To the project has been allocated 102.4 million euros from CEF in 2017. These three terminals represent the main entry points of a transmission network of pipelines and interconnectors in the corridor.

Map 7.

Natural gas pipelines in Central Europe



Source: CEEP

Another significant project for the corridor - Poland-Slovakia Gas Interconnection - aims to connect the natural gas transmission networks of these two countries. The project is expected to be finished by the end of 2021⁷. The main aim of the pipeline is to enhance diversification and security of gas supply of both countries⁸ and the EU supports this project through CEF in the amount of 107.7 million EUR⁹. Moreover, it will connect Slovakia to LNG terminal in Świnoujście that would also diversify sources of gas for Central Europe.

A similar project is the expansion of the interconnector (STORK II) between Poland and Czech Republic. It has been included on the list of PCI projects since 2013. STORK II is currently envisaged as a bi-directional interconnector with capacity of

5 (PL-CZ) and 6.7 bcm (CZ-PL) per year. Recently all necessary steps are being taken in order to initiate the permitting proceedings, while construction and execution are planned after 2022.

Another key diversification project with high impact on Central Europe is the Baltic Pipe. It is a strategic infrastructure project implemented by the Polish TSO Gaz-System in partnership with the Danish TSO Energinet, aimed at creating a new gas supply corridor from Norway to Poland and Central European market. The gas pipeline, which by 2022 should connect the gas systems of the countries and allow the transmission of up to 10 bcm of gas, will be a real alternative to the existing gas routes. The Baltic Pipe Project has a status of PCI and in 2018 received an additional €18.3 million in EU funding for pre-investment work.

Map 8. Baltic pipe project map



Source: <https://www.baltic-pipe.eu>

The other important project is the BG-RO-HU-AT gas corridor (commonly known as the BRUA pipeline), which secured financing of 100 million EUR from the European Investment Bank (EIB), and was awarded 179 million EUR grant under the CEF. The project would ensure interconnection of the gas transmission systems of Bulgaria and Romania with that of Hungary. The pipeline would allow access to future major gas infrastructure projects such as TAP, gas sources from Central European gas hubs and potential gas transportation from Black Sea deposits, and provide a new export route for future natural gas exploitation.

Another noteworthy project is Eastring – 1,208 km bidirectional gas pipeline with 20 bcm capacity to connect Central and South-Eastern European region which was also granted PCI status. The planned pipeline, promoted by EU stream – Slovak TSO and partners from Hungary, Romania and Bulgaria is at an early stage of preparations. Its feasibility study has been supported by CEF and presented on 20th of September 2018.

⁷ <https://www.mhsr.sk/uploads/files/UiknENpe.pdf>

⁸ <https://ec.europa.eu/energy/en/topics/infrastructure/trans-european-networks-energy>

⁹ <https://ec.europa.eu/inea/en/connecting-europe-facility/cef-energy/6.2.1-0019-skpl-w-m-16>

MARKET INTEGRATION

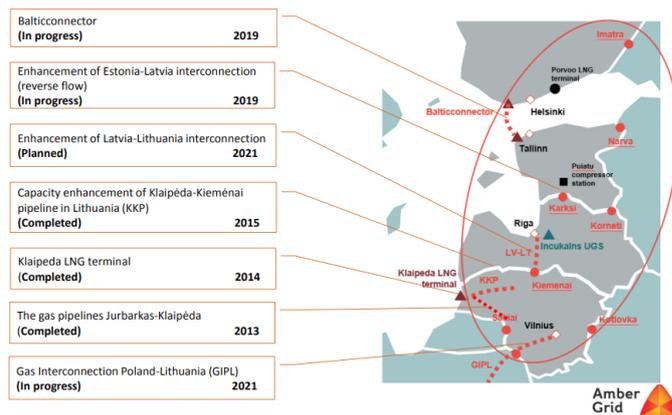
Infrastructure is the backbone of the internal energy market. It allows countries to take advantage of security of supply arrangements and to increase cross-border trade eventually leading to different forms of market integration. Nowadays there is a general consensus that the functioning of the EU's internal gas market is improving: market liquidity has been increasing, competition at the wholesale level is intense and wholesale prices are converging. However, in Central and South-East Europe, market inefficiencies are still observable due to missing infrastructure, source dependency and distortive tariffs at certain borders.

Since 2009 considerable conceptual work has been done, engaging research institutions from all V4 countries, which was followed up by concrete actions. Within the V4 Group, in October, 2012 a Memorandum of Understanding on gas market integration was signed, followed by the Roadmap towards Regional Gas Market Integration among V4 countries (2013). This strategy itself was recognized by ACER, which integrated it into the Regional Gas Initiatives – South, South, East Region (SSE). The strategy is based on two pillars – firstly it foresees physical interconnection of the region along the North-South corridor complemented by the second pillar - market design and integration.

A good example of cross-border energy cooperation in Central Europe is GET Baltic Project – a licensed natural gas market operator with a status of Registered Reporting Mechanism status provided by the ACER. The Company administers the electronic trading system for trading spot and forward natural gas products with physical delivery in the market areas located in Lithuania, Latvia, and Estonia. Such initiatives are intended to improve the regional security of supply by diversifying gas sources and to enable interconnection of the Baltic countries and their integration with the EU's common energy market.

A big step toward intensifying efforts at cross-border energy cooperation in Central Europe was launched in 2015 by FGSZ (owner and operator of the Hungarian high-pressure natural gas pipeline system servicing gas distribution companies, power plants and large industrial consumers), the first international capacity trading service in the region under the name of Regional Booking Platform (RBP). This platform supports integration of the neighbouring gas markets, because its use guarantees synchronization of the capacities of respective entry and exit sides across the borders in question.

Map 9. The main regional gas infrastructure projects in Baltic Countries



Source: Amber Grid

Map 10. The countries participating in the Regional Booking Platform (RBP)



Source: RBP

REGIONAL COOPERATION WITHIN THE ELECTRICITY SECTOR

INFRASTRUCTURE

The TYNDP for electricity is an ENTSO-E document aimed at monitoring supply potential, market integration and security of supply, and analyzing future scenarios for electricity. ENTSO-E publishes the TYNDP in every even year, which acts as a basis to derive the PCI list. TYNDP defines four TEN-E electricity priority corridors. Central European states are included in two corridors: North-south electricity interconnections in central eastern and south eastern Europe ('NSI East Electricity') and BEMIP Electricity. TYNDP 2018 outlines future capacity needs of the Regions given the

expected structural changes in the future power system. The long-term 2040 capacity needs are particularly analysed in the Regional Investment Plans, which were published at the end of 2017 by the six regional groups responsible for grid planning and other system development tasks.

The common challenge for Central European states is to strengthen interconnections and internal lines in north-south and east-west directions to complete the EU internal energy market and accommodate development of renewable energy sources. One of the key challenges for Central European States is the unscheduled power flows which - due to suboptimal market and bidding zones structure - significantly compromise cross-border capacities. It leads to a situation where relatively high degrees of interconnectivity are not serving development of regional trade.

Table 2. Interconnection levels by Member State as measured by nominal electricity interconnection capacity to peak load in 2030

Country	Vision 3	Vision 4
Slovenia	455%	440%
Poland	42%	40%
Lithuania	254%	219%
Estonia	191%	177%
Latvia	387%	317%
Croatia	282%	289%
Slovakia	212%	205%
Bulgaria	90%	83%
Romania	75%	73%
Hungary	218%	203%
Czech Republic	153%	124%

Source: Towards a sustainable and integrated Europe, Report of the Commission Expert Group on electricity interconnection targets, 2017

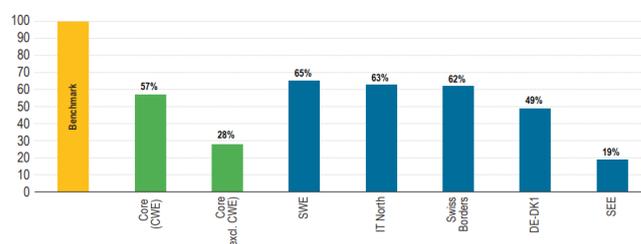
Table 3. Interconnection levels by Member State as measured by nominal electricity interconnection capacity to installed renewable generation capacity in 2030

Country	Vision 3	Vision 4
Slovenia	409%	293%
Poland	41%	45%
Lithuania	163%	170%
Estonia	176%	196%
Latvia	162%	168%
Croatia	205%	176%
Slovakia	187 %	170 %
Bulgaria	73%	72%
Romania	37%	30%
Hungary	544%	157%
Czech Republic	206%	206%

Source: Towards a sustainable and integrated Europe, Report of the Commission Expert Group on electricity interconnection targets, 2017¹⁰

The latest Market Monitoring Report by ACER from 2018 points out that the CEE region still has (almost) the lowest ratio of available tradable capacity to benchmark capacity on HVAC borders.

Figure 1. Ratio of available capacity to benchmark capacity on HVAC borders per Capacity Calculation Region – 2017%



Source: NRAs, Nord Pool, ENTSOE-E CGM (2017) and ACER calculations (2018)

In the coming years however, we may expect an increasing number of interconnections. All Central European states recognize a need to strengthen the transmission capacities of their internal energy systems. The main challenge remains a market structure with uncertainties that accompany cross-border capacity calculations and allocations in the highly meshed grid of the region. Still, the countries recognize the importance of infrastructure development, as can be observed in the main cross-border projects listed in the following table.

¹⁰ The report introduces new formulas of measurement of interconnection level: a) the ratio of the nominal transmission capacity to the peak load (demand) and b) the ratio of the nominal transmission capacity to the installed renewable generation capacity (supply). The Member States were divided on three categories: below 30% between 30%-60% and above 60%. Countries below 30% should consider to develop the interconnections. Report available at: https://ec.europa.eu/energy/sites/ener/files/documents/report_of_the_commission_expert_group_on_electricity_interconnection_targets.pdf

Table 4. Main planned interconnections projects in CEE region

Project name	Cluster of which it is part of	Corridor
400 kV overhead line (OHL) Cernavoda – Stalpu	Bulgaria–Romania capacity increase	Black Sea Corridor
400 kV overhead line (OHL) Gutinas – Smardan	Bulgaria–Romania capacity increase	Black Sea Corridor
400 kV overhead line (OHL) Suceava – Gadalin	Bulgaria–Romania capacity increase	Black Sea Corridor
Interconnection between Resita (RO) and Pancevo (RS)	Cluster Romania – Serbia between Resita and Pancevo	Mid Continental East Corridor
Internal line between Portile de Fier and Resita (RO)	Cluster Romania – Serbia between Resita and Pancevo	Mid Continental East Corridor
Internal line between Resita and Timisoara/Sacalaz (RO)	Cluster Romania – Serbia between Resita and Pancevo	Mid Continental East Corridor
Interconnection between Gabčíkovo (SK) and Gönyü (HU) and Veľký Ďur (SK) (cross-border lines 2x400 kV)	Slovakia-Hungary cross-border capacity increase	North-South electricity interconnections in Central Eastern and South Eastern Europe
Interconnection between Sajovánka (HU) and Rimavská Sobota (SK) (cross-border lines 2x400 kV)	Slovakia-Hungary cross-border capacity increase and support existing market coupling between the Czech Republic, Slovakia, Hungary and Romania	North-South electricity interconnections in Central Eastern and South Eastern Europe
Internal line between Krajnik and Baczyna (PL)	Increase of the transmission capacity between Germany and Poland	„GerPol Power Bridge“
Internal line between Mikułowa and Świebodzice (PL)	Increase of the transmission capacity between Germany and Poland	„GerPol Power Bridge“
Internal line between Baczyna and Plewiska (PL)	Increase of the transmission capacity between Germany and Poland	
Baltic synchronization covering a new projects for internal grid reinforcements - new 330 kV and 400 kV AC lines, voltage stabilizer units, upgrades of PSS in power stations, internal 110 kV network reinforcement and separation of the 110kV Baltic grid from the IPS/UPS system, DC convertor stations on the borders with Russia, Belarus and Kaliningrad	Baltic Synchro with CE with AST,ELERING and LITGRID	Synchronization of the Baltic power grids with the Continental European system
Internal line between Verněřov-Vítkov	Cross-border capacity increase and support existing market coupling	Czech Republic’s north-western and southern borders
Internal line between Vítkov-Přeštice	Cross-border capacity increase and support existing market coupling	Czech Republic’s north-western and southern borders
Internal line between Přeštice-Kočín	Cross-border capacity increase and support existing market coupling	Czech Republic’s north-western and southern borders
Internal line between Kočín-Mírovka	Cross-border capacity increase and support existing market coupling	Czech Republic’s north-western and southern borders
Internal line between Mírovka-Čebín	Cross-border capacity increase and support existing market coupling	Czech Republic’s north-western and southern borders
Interconnection between Žerjavenec (HR)/ Hévíz (HU) and Cirkovce (SI)	Croatia cross-border capacity increase	Corridor North-South Electricity Interconnections in Central Eastern and South Europe
Slovenia-Hungary/Croatia interconnection	Slovenia-Hungary/Croatia capacity increase	

Source: European Commission, Third PCI List.

Network codes

For the time being, the network codes are considered to be a tool that may work out most of the electricity market issues. Network Codes consist of eight legal acts, whose main objective is to facilitate harmonization, integration and efficiency of the European electricity market.

However, the network codes indeed represent a huge pool of rules that have to be implemented. First of all, it should be noted that the process of building up operation of the network codes has taken significantly longer than was originally expected. They were initiated in the beginning of 2011, but the last of them were adopted at the end of 2017. Currently, TSOs and NRAs are busy implementing them, and the implementation effort will take at least until 2020. The reason for that is the very complexity of implementation process.

One of the main tasks for TSOs within the implementation process was to develop and create the capacity calculation regions (CCR). In effect 10 CCRs were created. The biggest one is the Core CCR created by 16 TSOs from 13 countries, covering the largest part of central continental Europe. The CCRs are obliged to cooperate and develop methodologies as envisaged in the network codes, so that the NRAs may adapt them. Within CCRs, common implementation of requirements, i.e. network codes, is taking place with a view to harmonising the operational procedures and creating a single electricity market. The key element of this harmonisation is preparation of the methodologies for transmission capacity calculation and allocation based on physical flows (i.e. the flow-based methodology, as well as a methodology for cost sharing of remedial action needed to keep the system secure in view of the growing volumes of the loopflows), in order for the day-ahead and intraday markets to operate effectively.

Map 11. Core Capacity Calculation Region



Source: <https://www.tscnet.eu/tag/capacity-calculation/>

Network Codes implementation requires harmonisation of operation of the wholesale electricity markets including: Long-term markets, Day-Ahead Market (DAM), Intraday Market (IDM) and Balancing Market. In terms of DAM, the Multi-Regional Coupling (MRC) project is in the midst of implementation, which encompasses 23 countries where the Market Coupling mechanism has been used. In the case of Intraday Market, there is the Cross-Border Intraday Market (XBID) project, which was launched in June 2018 in 14 EU countries and is being developed further with the aim of the second wave going live in June 2019. XBID aims to enable continuous cross-zonal trading and increase the overall efficiency of Intraday trading across the single cross-zonal Intraday EU market. Work is also underway on balancing markets and balancing services according to the Electricity Balancing Guideline (projects named Mari, Picasso, Terre and IGCC).

MARKET COUPLING IN CENTRAL EUROPE

In November 2014 4M Market Coupling (4M MC) was launched which has integrated the markets of four countries: Czech Republic, Hungary, Romania and Slovakia, run by respective power exchanges OTE, HUXP, OPCOM and OKTE¹¹. The 4M MC has been considered as one step towards the single European power market and an intermediate step in the regional market coupling solution. 4M MC is an ATC based day-ahead auction with implicit allocation, aiming to be compatible with the EU target model to the highest possible standard.

The project aimed at the implementation of the Price Coupling of Regions (PCR) solution. The PCR initiative has allowed market participants to trade on the day-ahead market in the Czech Republic under the same conditions as in Western Europe. This solution is also seen as a starting point for implementation of a uniform target solution in Eu-

¹¹ <http://www.ote-cr.cz/o-spolecnosti/files-novinky/pcr-pr-4m-mc-launch.pdf>

rope within the scope of the plan for the joint implementation and performance of the functions of Market Coupling Operator in line with the CACM Regulation.

In addition, the Market Operator strives to seek out other possibilities for expansion, with a priority goal of coupling 4M MC with the already integrated Western European region (MRC). Furthermore, in connection with the implementation of the Cross-Border Intraday Market Project – XBID, which serves as a basis for the coupling of intraday electricity markets, cooperation has been launched with the transmission system operators and the appointed NEMOs active in Austria, Czech Republic, Germany, Poland, Hungary, Romania, Croatia and Slovenia, regarding a local implementation project aimed at the integration of the relevant intraday electricity markets.

Poland is coupled with Lithuania via LitPol link and with the Nordic part of Europe via SwePol undersea DC link.

Moreover, Croatia and Slovenia, with their regulatory authorities involved, have launched the Market Coupling Project (MRC) in June 2018. The border between Croatia and Slovenia, which became a part of the Multi Regional Coupling, is from June onwards allocated through Price Coupling of Regions (PCR) solution for the Day-Ahead markets.

Market coupling is intended to achieve a higher efficiency of trading and capacity allocation, which leads to a higher security of supply, higher liquidity and lower price volatility.

REGIONAL SECURITY COORDINATORS

Starting in 2008 TSOs began to develop Regional Security Cooperation Initiatives (RSCIs), also known as Regional Security Coordinators (RSC). The RSCs are companies owned by the TSOs. They perform services for the TSOs, such as providing coordinated operational safety assessments, short- and medium-term system adequacy projections, coordinated capacity calculation, coordinated outage planning and common network models.

Based on a multilateral agreement signed in December 2015, all TSOs in ENTSO-E are required to join a RSC. Due to the complexity of these tasks and the emerging IT difficulties, the initial deadline for joining a RSC was first extended until the end of 2018, and then until the end of 2019.

Map 12. Current state of play of single day ahead Coupling (July 2018)

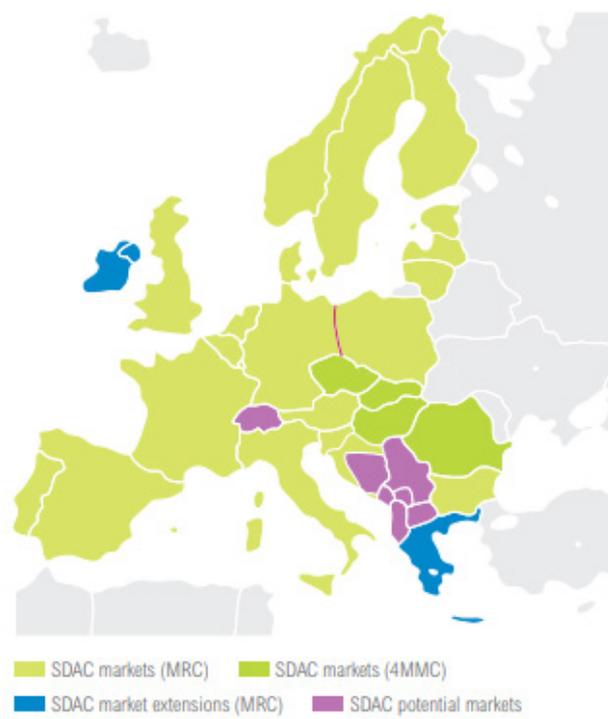


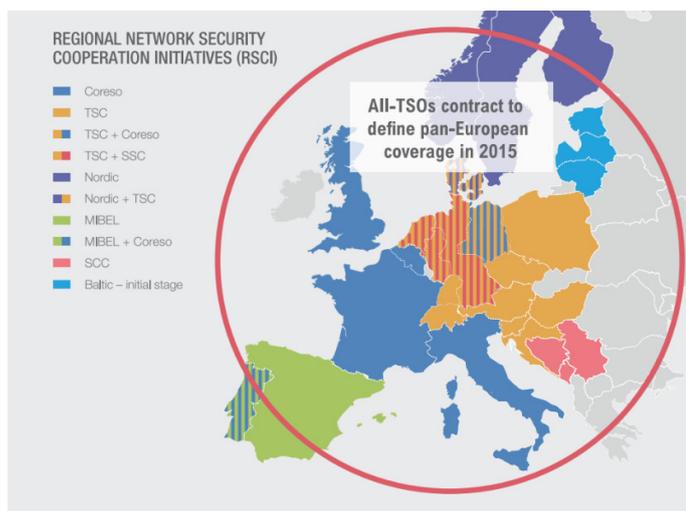
Figure 4: Current state-of-play of Single Day-ahead Coupling (As of July 2018)*

Source: <https://docstore.entsoe.eu>

Most of Central European countries are part of RSC TSCNET, which was established in 2008. It serves Austria, the Czech Republic, Slovenia, Denmark, Croatia, Germany, Hungary, the Netherlands, Poland, and Switzerland, as well as Slovakia and Romania from 2018. The company provides technical support services for TSOs in operational planning processes and support for the implementation of conceptual tasks carried out as part of the TSO Security Cooperation regional initiative.

Baltic countries are included in the separate Baltic RSC, which was created based on the Baltic Regional Security Coordinator Agreement signed in October 2016.

Map 13. Regional Network Security Cooperation Initiatives



Source: ENTSO-E vision package

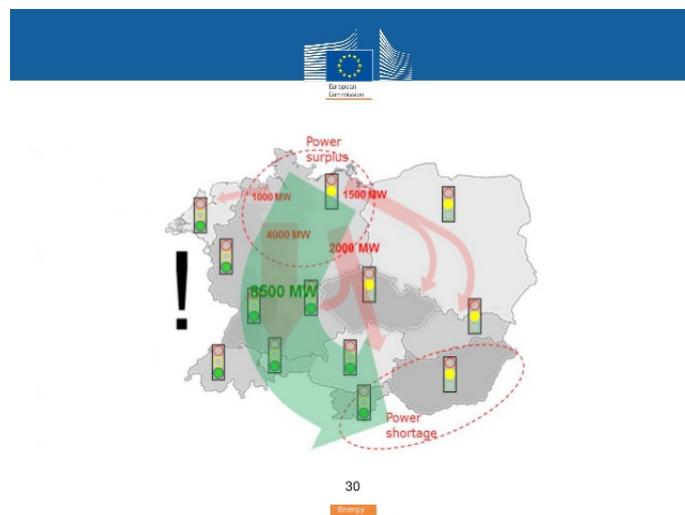
LOOP FLOWS AS A PROBLEM FOR REGIONAL COOPERATION AND SECURITY OF SUPPLY

One of the main challenges for Central Europe, which is undermining regional cooperation in the electricity sector, are loop flows. To a limited level, loop flows are natural for any highly meshed synchronous grid. In Central Europe though, they are mainly a result of congestions within the internal grid of Germany, which is unable effectively to transit electricity from renewable sources (mainly from wind farms in the north) to the south of Germany and further down to Austria and to southern Europe. As a consequence, the power grids of Poland, Czech Republic, Slovakia and Hungary are congested by these unscheduled flows. Also, they block a significant portion of transmission capacities on the borders of the CEE countries, making them available for the local traders only to a limited degree. Loop flows are an integral part of the zonal market model applied in Europe. The more the bidding zones in the EU are inadequately defined, i.e. not based on congestions, but rather an inheritance of national borders, the more significant disproportions in size and internal grid underdevelopment are the result.

However, there are some solutions to the problem of unscheduled flows. One of the latest key achievements which could help the development of cooperation was the split of the Germany-Austria-Luxembourg bidding zone into DE-LU / AT. Currently, regional TSOs are working on the rules for cross-border flow based capacity calculation in the Core region. Effective coordination and improvement in methodology of capacity calculation and allocation can contribute to solving problems of unscheduled transit flows in Central

Europe. Also, reinforcements of the grid within zones to minimize the gap between the assumed copperplate and reality, or splitting the zones into smaller ones to better reflect energy systems capability can also help.

Map 14. Loopflows in Central Europe



Source: O.Koch, DG Energy presentation, <https://www.slideshare.net/FSRenergy/completing-the-internal-energy-market>

INNOVATION DRIVEN COOPERATION

Analyzing region wide cross-border projects related to electricity mostly within Horizon 2020 program, a majority of these research projects have wide geographic coverage. The analysis of these projects shows that the entities from Central Europe are usually participating in projects that involve partners beyond the region, from all over Europe. Therefore, the research activities ensure the possibility of spreading the latest innovative knowledge all over the continent. Concerning the projects' topics, we see that they are dealing with very different areas; however, research related to smart networks and developing software for increasing energy efficiency and smart network optimization are the most common ones. Within a wide range of different projects, several had a strictly Central European focus.

Another interesting project, included on PCI list, is ACON (Again Connected Networks) between the Czech Republic and Slovakia. The main goal of ACON is to foster the integration of Czech and Slovak electricity markets, increase competition in the region, and ensure adequate quality, safety and reliability of electricity supply. The existing distribution network will be modernized and improved before basing a smart grids pilot project on it.

SINCRO.GRID is on the PCI list from 2015, the project has been allocated 40.5 million euros by the CEF in 2017, and that amount represents 51% of the project's value. The project aims to increase the security of supply and tackle the problem of voltage in the 220kV and 400kV electricity grids in transmission systems in Croatia and Slovenia, together with transit flows in both countries. This problem cannot be approached individually but rather in cooperation by both countries.

Another good example of innovation-driven cooperation in Central Europe is a project named CROSSBOW. Border management of variable renewable energies and storage units enabling a transnational wholesale market is a project within the framework of the Horizon 2020 program. CROSSBOW is a multi-partner project implemented by TSOs and the consortium involves 24 partners: academic, commercial and non-profit. Participants in the CROSSBOW project are from Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Germany, Greece, Macedonia, Montenegro, Romania, Serbia, Slovenia, Spain, Ukraine, and TSOs representing eight countries located in South-Eastern Europe. The duration of the project is 48 months from November 2017 until October 2021, and its budget is 22 million euros, with an EC contribution of 17.2 million euros. At this moment, CROSSBOW is one of the most relevant innovation projects in the field of smart grids in the EU.

V4 could also play the role of a platform for cooperation concerning innovation. Czech Republic, Slovakia, Poland and Hungary take part in the Visegrad Initiative for Nuclear Cooperation (VINCO), which led to the inception of the Allegro projects. Allegro is an experimental fast reactor cooled with Helium, being developed by the European V4G4 Consortium "V4G4 Centre of Excellence" of the nuclear research organizations of the Czech Republic, Hungary, Poland and Slovakia associated with CEA, France. Its development is an important step on the way to the Gas-cooled Fast Reactor, one of the six concepts selected by the Generation IV International Forum, and one of the three fast reactors supported by the European Sustainable Nuclear Energy Technology Platform.

A possible platform for regional cooperation is European Battery Alliance (EBA), which was launched by the EC with Member States and industry in October 2017. The direct objective of this platform is to create a competitive production value chain in Europe, with sustainable battery cells at its core. This cooperative platform nowadays gathers together the EC, interested EU countries, the EIB and over 260 industrial and innovation stakehol-

ders. For Europe, battery production is a strategic imperative for the transition to clean energy and modernization and competitiveness of its industries, including the automotive sector.

Central European countries are top manufacturers of vehicle components, and therefore actively interested in the development of e-mobility. Several entities from Central Europe have joined EBA and are engaged in the different work streams of this organization. These are namely from: Czech Republic - HE3DA, MES; Poland - PKN Orlen, Lotos Lab, Rafako, KGHM, Grupa Azoty, Polish Development Fund; Lithuania - Invest in Lithuania Agency. Moreover, Central European countries are recipients of massive foreign investments in battery technologies, mostly at e-vehicle battery manufacturing sites. Poland attracted LG Chem's investment in a lithium-ion batteries factory worth 330 million EUR, while Umicore decided also to invest 660 million EUR in the factory of cathode. Another important destination is Hungary, which attracted SK Innovation investment of 656 million EUR and Samsung SDI invested 320 million EUR in another factory. Slovakia is competing for the Tesla car production site. CEE countries are on a good track to becoming an important element in the global supply chain of battery technologies.

CONCLUSIONS AND RECOMMENDATIONS

Central European countries are fully engaged in regional cooperation both within the EU initiatives as well as along horizontal lines within V4 or Three Seas Initiative. Crucially, such cooperation is already bringing tangible results that are visible for example, in already constructed infrastructure projects and market integration. Clearly, Central European states are the winners in regional cooperation and further tightening of this process is in their vital interest. It is a means of increasing performance of their domestic markets and their resilience to supply shocks.

An important role in this process is played by EU bodies, which through the implementation of various programs and initiatives support it in order to create significant synergies for achieving the objectives of the EU energy policy. These include synergies in such areas as: security of supply and diversification of energy sources, competitiveness and unification of the internal energy market, increase in energy efficiency, sustainable development, research and development of innovative technologies of energy production and transmission, and construction of new energy infrastructure, including connections between national systems.

In order to further improve energy cooperation in Central Europe, CEEP recommends:

- EU financial support in the form of CEF and other funding mechanisms adds a crucial impetus to development of new infrastructure in Central Europe. PCI status is a prerequisite for successful implementation of diversification projects. The EU support serves as catalyst for regional cooperation. Thus in financial planning for 2021-2027 budget the EU should spearhead and designate sufficient resources for programs like CEF or ERDF.
- The regional cooperation should follow bottom-up logic rather than top-down. In this regard the EU coordination is one of deciding factors facilitating it. Flexibility is the key feature supporting it. A good example of following this pattern is activation of the Regional Security Coordinators, which were initiated among TSOs and were responses to clearly visible problems in the grids. A clearly identified necessity drove their development and determined their importance. On the other hand, administratively imposed obligations and measures like the proposed Regional Operation Centres would not guarantee the desired outcomes.
- Improving the Central European cross-border market will require progress in all domains: grid investments, better bidding zone delimitation and better coordination of cross-border trade. The most effective implementation of solutions to problems related to the transmission and supply is possible mostly at the regional level. Therefore, the development of a regional platform/industry association which would discuss the specific regional challenges for CEE should be supported.
- Governance of the Energy Union regulation could bring the qualitative change in the approach to the coordination of energy policies in the region. Consultation and cooperation at the regional basis, prior to the adoption of INECs are necessary to ensure that national choices regarding energy policy do not affect stability of energy systems of neighbouring states or harm their security of supply levels.
- Governance should remain a key element of the implementation of the EU energy and climate policies, providing stable regulatory framework till 2030 and beyond. However,

it shall be introduced according to the subsidiarity principle and stay in line with the technology neutrality and cost-effectiveness principles.

- With regard to electricity, loop flows originating in Germany are the most prominent problem in the regional context. Over the short term, the safety and reliability of the transmission system's operation is being ensured through modernization of interconnectors and their reinforcement, with the phase shifting transformers onto the most heavily loaded lines. On the other hand, long term solutions such as redesign of the internal market rules are needed, as only those would eventually remedy the loop flows.
- In the gas sector, implementation of the projects aimed at diversification of sources of supply and routes is a clear priority for the region. Regarding those infrastructure projects that are characterised by diverging interests of different countries within the region, a fair risk mitigation process should be applied and competition on an infrastructure-to-infrastructure level should be avoided. Similarly, close cooperation is needed to take full advantage of the existing EU security of supply arrangements.
- Visegrad group presents an important platform for discussion of energy policy among Central European countries. Although there are natural divergences among V4 states, there are also important synergies that enable fruitful cooperation. In the coming

years, energy cooperation should be further strengthened within the V4 format. It might be a useful platform for joint planning on energy sector developments and to facilitate data sharing in order to pave the way for enhanced cross-border energy cooperation.

- The Three Seas Initiative may provide a wider platform for energy related cooperation in order to foster synergies among many countries of the region. The concept may provide a venue for regional energy businesses to meet and seek political involvement to help the energy identity of the region to emerge.
- The area where cooperation is still not sufficiently exploited is innovation. As most of the Central European companies share the same challenges and problems related to the need to update their technology - be it grid or generation, and to adapt them to environmental standards, they should find synergies in common approaches. Moreover, the wider spread of e-mobility and batteries production seems to offer a clear, singular focus for the whole region. The EU legislation and financing should be aimed at facilitating such cooperation and creating the essential ingredient of flexibility, as nobody can predict future developments in technology.

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CEEP represents the interests of the energy and energy-intensive companies from Central Europe in order to promote balanced energy transition in accordance with technological neutrality principle, enhance regional cooperation and strengthen the region's energy security within the framework of EU energy and climate policy.

CEEP is an international non-profit association. It is the first major body to represent the region at the EU level.

