

**OPINION OF THE AGENCY FOR THE COOPERATION OF ENERGY  
REGULATORS No 09/2015**

**of 23 September 2015**

**ON THE COMPLIANCE OF NATIONAL REGULATORY AUTHORITIES'  
DECISIONS APPROVING THE METHODS OF ALLOCATION OF CROSS-  
BORDER TRANSMISSION CAPACITY IN THE CENTRAL-EAST EUROPE  
REGION WITH REGULATION (EC) NO 714/2009 AND THE GUIDELINES  
ON THE MANAGEMENT AND ALLOCATION OF AVAILABLE TRANSFER  
CAPACITY OF INTERCONNECTIONS BETWEEN NATIONAL SYSTEMS  
CONTAINED IN ANNEX I THERETO**

THE AGENCY FOR THE COOPERATION OF ENERGY REGULATORS,

HAVING REGARD to Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators<sup>1</sup> ("the Agency"), and, in particular, Article 7(4) and 17(3) thereof,

HAVING REGARD to the favourable opinion of the Board of Regulators of 16 September 2015, delivered pursuant to Article 15(1) of Regulation (EC) No 713/2009,

WHEREAS:

**1. PROCEDURE**

- (1) On 2 December 2014, the Agency received a request from Urząd Regulacji Energetyki ("URE"), the National Regulatory Authority ("NRA") of Poland, for an opinion, pursuant to Article 7(4) of Regulation (EC) No 713/2009, on the compliance of the decisions of Agencija za energijo ("AGEN-RS"), the Slovenian NRA, No 141-4/2013-09/203 of 23 October 2013, of Energie-Control Austria ("E-Control"), the Austrian NRA, No V AUK 02/13 of 11 October 2013, of Magyar Energetikai és Közmű-szabályozási Hivatal ("MEKH"), the Hungarian NRA, No 2538/2014 of 12 August 2014 and No 2890/2014 of 4 November 2014, and of Úrad pre reguláciu sieťových odvetví ("ÚRSO"), the Slovakian NRA, No 0027/2014/E-PP of 22 August 2014, with Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003<sup>2</sup> and the Guidelines on the management and allocation of available transfer

<sup>1</sup> OJ L 211, 14.8.2009, p. 1.

<sup>2</sup> OJ L 211, 14.8.2009, p. 15.

capacity of interconnections between national systems (the “Guidelines”) contained in Annex I thereto.

- (2) By email of 5 December 2014, the Agency invited the NRAs of the Central-East Europe (“CEE”) region countries, excluding Poland, i.e. Austria, the Czech Republic, Germany, Hungary, Slovakia and Slovenia, to send their written observations with regard to the request of the Polish NRA.
- (3) The Agency received written comments from MEKH on 16 December 2014, from Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen (“BNetzA”), the German NRA, on 19 December 2014, from E-Control on 22 December 2014, and from Energetický regulační úřad (“ERO”), the Czech NRA, on 2 January 2015. AGEN-RS and ÚRSO did not reply.
- (4) On 17 February 2015, the Agency requested from the Polish, Czech and German NRAs data on Power Transfer Distribution Factors (“PTDFs”) for cross-border exchanges between Germany and Austria for specific network elements.
- (5) The Agency received the following replies to its 17 February 2015 request: from the Polish NRA on 13 March 2015, updated on 27 March 2015, from the Czech NRA on 12 March 2015, updated on 24 March 2015, and from the German NRA on 10 April 2015.
- (6) BNetzA and E-Control provided further written comments, respectively on 3, 12, 19 and 23 June 2015 and on 2, 19 and 23 June 2015.

## 2. THE REQUEST

- (7) URE requests the Agency’s opinion on whether the decisions of the Austrian, Hungarian Slovakian and Slovenian NRAs approving the methods of allocation of cross-border transmission capacity in the CEE region comply with the provisions of the Guidelines, as well as with the provisions of Regulation (EC) No 714/2009.
- (8) URE’s specific concern is that the decisions of the Austrian, Hungarian, Slovakian and Slovenian NRAs approve the methods of allocation of cross-border transmission capacity even though the methods themselves do not provide for a capacity allocation procedure for the German-Austrian (“DE-AT”) border.
- (9) URE considers that the absence of a capacity “*allocation procedure for cross-border capacity used for commercial transactions between Austria and Germany results in significant power flows through the transmission grid of neighbouring transmission system operators breaching network security standards and leading to the occurrence of*

*structural congestion, if not on the specific German-Austrian border, at least on other parts of the CEE network”.*

- (10) According to URE, the absence of a capacity allocation procedure on the DE-AT border reflects an overall insufficient coordination in the region. It leads to cross-border exchanges in the CEE region being treated in a discriminatory, non-market-based way, and it provides for inefficient economic signals to the involved market participants and to Transmission System Operators (“TSOs”).
- (11) On the basis of a legal and technical assessment, URE concludes that the methods for allocating cross-border transmission capacity currently applied by the TSOs in the CEE region and endorsed by the respective NRAs’ decisions do not comply with Regulation (EC) No 714/2009 and with the provisions of its Guidelines. Accordingly, URE requests the Agency to provide an opinion on the compliance or the absence of it.
- (12) The request is related to the ongoing administrative proceedings pending with URE and concerning the approval of allocation methods of cross-border transmission capacity.

### **3. THE DECISIONS AND COMMENTS OF THE NRAS CONCERNED**

- (13) The decision of the Slovenian NRA, No 141-4/2013-09/203 of 23 October 2013, accepts the Rules for Coordinated Auction of Transmission Capacity in the CEE Region.
- (14) The decision of the Austrian NRA, No V AUK 02/13 of 11 October 2013, approves the Rules for Coordinated Auction of Transmission Capacity in the CEE Region. According to this decision, the Rules for Coordinated Auction of Transmission Capacity in the CEE Region were elaborated jointly by the TSOs of the CEE region and govern the allocation of cross-border transmission capacity for the following borders: Austria-Czech Republic (“AT-CZ”), Austria-Slovenia (“AT-SI”), Austria-Hungary (“AT-HU”), Czech Republic-Germany (“CZ-DE”), Czech Republic-Poland (“CZ-PL”), Slovakia-Poland (“SK-PL”) and Slovakia-Hungary (“SK-HU”).
- (15) The decision of the Hungarian NRA, No 2538/2014 of 12 August 2014, approves the Rules for Coordinated Auction of Transmission Capacity in the CEE Region; its decision No 2890/2014 of 4 November 2014, approves an update of those rules.
- (16) The decision of the Slovakian NRA, No 0027/2014/E-PP of 22 August 2014, approves the “regulations” of the Slovakian TSO. It does not explicitly refer to the Rules for Coordinated Auction of Transmission Capacity in the CEE Region.

- (17) The German NRA considers that URE's request is inadmissible as it aims for an opinion on bidding zones configuration, a subject-matter of an already ongoing, more specific and comprehensive, process of early implementation of the bidding zones review in Europe. Therefore, URE would have no legal interest. Further, an Agency's opinion would affect and prejudice the early implementation of the bidding zones review and undermine the implementation of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (the "CACM Guideline")<sup>3</sup>.
- (18) BNetzA also considers URE's request to be unjustified as the arguments raised by URE are based on obsolete, incomplete and outdated data/studies. The fact that specific measures were taken to address the problem i.e. with the virtual Phase-Shifting Transformers (vPSTs), the TSO Security Cooperation (TSC) project and the planned installation of physical PST, is not taken into account.
- (19) The Austrian NRA considers the fact-based reasoning provided by URE, emphasising the correlation between the schedules<sup>4</sup> on the DE-AT border and unscheduled flows<sup>5</sup> between Germany and Poland, as insufficient. According to E-Control, the statistics on occurrences and duration of security threats and security violations provided by URE, without analysing each case on its own, do not allow to establish a causal link with the schedules on the DE-AT border.
- (20) Moreover, E-Control concludes that loop flows and unscheduled flows are inherent to a zonal market model and that there are no objective criteria determining to what extent such flows need to be tolerated.
- (21) E-Control finds that there is sufficient evidence showing that the DE-AT border is not structurally congested and that capacity allocation procedures should only be applied in cases where no other cost-efficient and technically-effective measures are available. The mitigating measures (operational, through redispatching, or structural, through network investments) currently implemented or planned to be implemented by TSOs constitute an effective remedy to congestions in the CEE region.

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<sup>3</sup> OJ L 197, 25.7.2015, p. 24.

<sup>4</sup> A schedule, or also referred to as a cross-border exchange, is a declared flow resulting from a scheduling process, related to an electricity exchange between two different control areas and/or bidding zones. For a comprehensive description see p. 94 of the 2<sup>nd</sup> edition of the Market Monitoring Report (MMR), see:

([http://www.acer.europa.eu/Official\\_documents/Acts\\_of\\_the\\_Agency/Publication/ACER%20Market%20Monitoring%20Report%202013.pdf](http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202013.pdf)).

<sup>5</sup> Unscheduled flows are the difference between schedules and physical flows. They are also the sum of unscheduled transit flows (UTF) and loop flows (LF) over a border – see also footnote 4.

- (22) According to E-Control, the introduction of a capacity allocation procedure on the DE-AT border would not efficiently and effectively address the roots of the problem raised by URE and would only have a very limited positive impact on the security of the Polish grid.
- (23) According to E-Control, the bidding zones review process, as described in the CACM Guideline, should be the appropriate tool to analyse bidding zones configurations and to propose a structural solution<sup>6</sup>. E-Control however considers that reconfiguring bidding zones by market splitting might constitute an infringement of the Treaty on the Functioning of the European Union (Articles 34, 35, 101 and 102 TFEU).
- (24) The Czech NRA considers that URE's request for an Agency's opinion is fully compliant with Article 7(4) of Regulation (EC) No 713/2009. ERU supports URE's legal and technical assessment of the existing situation in the CEE region.
- (25) The Hungarian NRA also supports URE's assessment.

#### **4. ADMISSIBILITY**

- (26) Pursuant to Article 7(4) of Regulation (EC) No 713/2009, an NRA can request the Agency's opinion on whether a decision taken by a regulatory authority complies with the Guidelines referred to in Directive 2009/72/EC, Directive 2009/73/EC, Regulation (EC) No 714/2009 or Regulation (EC) No 715/2009 or with other relevant provisions of those Directives or Regulations. Article 7(4) does not make the admissibility of the request conditional upon whether or not the same or a related topic is also addressed under a different procedure, or upon whether or not the requesting NRA has a legal interest.
- (27) URE's request addresses the Agency with a question on whether the NRAs' decisions attached to the request and approving the methods for allocating cross-border transmission capacity in the CEE region comply with the provisions of the Guidelines annexed to Regulation (EC) No 714/2009 and with the provisions of Regulation (EC) No 714/2009 itself. As such, this request is in line with the requirements of Article 7(4) and admissible. In addition, URE has indeed a specific legal interest in the Agency's opinion as it deems the opinion relevant for its decision in the proceedings addressed to URE which are still pending.
- (28) Therefore, the Agency considers URE's request pursuant to Article 7(4) of Regulation (EC) No 713/2009 as admissible.

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<sup>6</sup> In that respect, E-Control regrets that the current exercise undertaken by ENTSO-E still exhibits drawbacks and as such might not provide a proper basis for further conclusions.

## 5. BACKGROUND

### 5.1 Bidding zones

- (29) In Europe, wholesale electricity markets are structured in bidding zones, featuring equal prices within them. Within each bidding zone, any consumer is allowed to contract power with any generator without limitations and hence disregarding the physical reality of the transmission network. This simplification, which aims at facilitating trade within each bidding zone, is however often made at the expense of electricity trading between bidding zones. For the latter, TSOs indeed apply capacity allocation methods through which they, ex-ante and most of the time, limit the amount of the available cross-zonal capacity (i.e. net transmission capacities (NTCs)) to ensure that physical flows, including inside zones, remain within the network operational security limits<sup>7,8</sup>.
- (30) For historical reasons, the bidding zones' boundaries mostly correspond to the borders between EU Member States, even though some Member States (e.g. Italy and Sweden) are split into several bidding zones. However, in the CEE region, Austria and Germany constitute a single bidding zone and no capacity allocation is applied on the border between them.

### 5.2 Congestion

- (31) Congestion between bidding zones materialises when there is more demand for capacity for cross-zonal trade than the available transmission capacity. As a result, wholesale electricity prices in two or more bidding zones deviate.
- (32) The primary legal framework for dealing with congestion problems is Regulation (EC) No 714/2009, which associates the term “congestion” with a very specific situation. Article 2(2)(c) of Regulation (EC) No 714/2009 defines congestion as “a situation in which an interconnection linking national transmission networks cannot accommodate all physical flows resulting from international trade requested by market participants, because of a lack of capacity of the interconnectors and/or the national transmission systems concerned”. Further, the Guidelines refer, in point 1.2, implicitly to congestions which occur usually

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<sup>7</sup> In reality, the observed NTC values mostly do not reflect the physical capacities of interconnectors.

<sup>8</sup> The Agency notes that according to Regulation (EC) No 714/2009, a situation where capacity constraints inside zones are considered in cross-zonal capacity calculation and allocation may be tolerated only as a short-term solution. Namely, point 1.7 of the Guidelines on the Management and allocation of available transfer capacity of interconnections between national systems annexed to that Regulation specify that “...TSOs shall not limit interconnection capacity in order to solve congestion inside their own control area, save for the abovementioned reasons and reasons of operational security. If such situation occurs this shall be described and transparently presented by the TSOs to all the system users. Such a situation shall be tolerated only until a long-term solution is found. The methodology and projects for achieving the long-term solution shall be described and transparently presented by the TSOs to all the system users.”

and, in point 1.4, explicitly to congestions which are structural, however without specifying the meaning of “usually” and “structural” in that context.

(33) In addition, the CACM Guideline, which supplements Annex I to Regulation (EC) No 714/2009, lays down a definition of structural congestion as well as of the equally-relevant term of physical congestion. Those definitions, which in the Agency’s view reflect the common understanding of “structural congestion” and “physical congestion” applicable for the purpose of Regulation (EC) No 714/2009, provide that:

- Structural congestion is a congestion in the transmission system that can be unambiguously defined, is predictable, is geographically stable over time and is frequently reoccurring under normal power system conditions (Article 2(19) of the CACM Guideline);
- Physical congestion occurs when forecasted or realised power flows violate the thermal limits of the elements of the grid, the voltage stability or the angle stability limits of the power system (Article 2(18) of the CACM Guideline).

(34) According to the definition of congestion pursuant to Regulation (EC) No 714/2009, an interconnection linking national transmission networks cannot accommodate all physical flows resulting from international trade requested by market participants when these trade requests result in physical flows over network elements which are physically congested. Therefore, a situation may occur where the network elements on an interconnection are not physically congested, but where there is nonetheless congestion on the interconnection because international trade requests on this interconnection cause physical flows over physically congested network elements somewhere else in the network. By analogy, the interconnection is to be considered as *structurally* congested when it cannot accommodate all physical flows resulting from international trade requested by market participants, because these trade requests would result in physical flows over network elements which are structurally (physically) congested<sup>9</sup>.

### 5.3 Unscheduled flows

(35) Cross-border electricity exchanges over the interconnections need to be scheduled to TSOs on both sides of these interconnections. Nevertheless, physical electricity flows on the interconnections usually do not match the scheduled flows and the difference between the

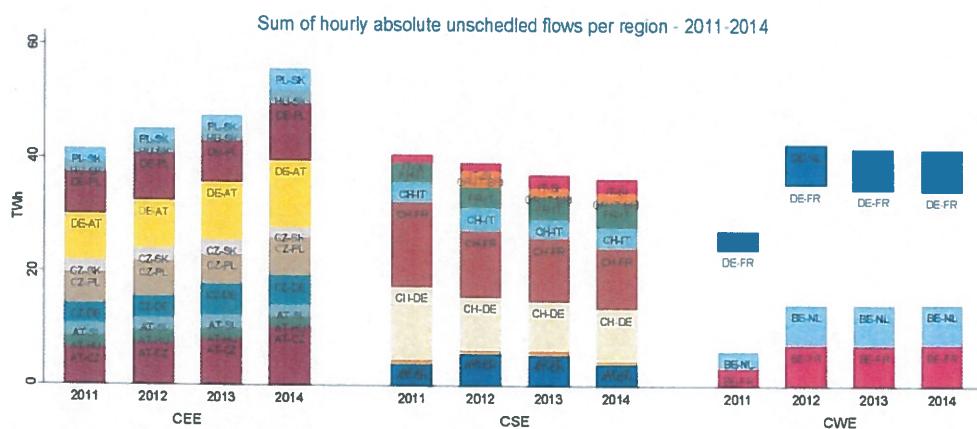
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<sup>9</sup> While the legal definition refers to interconnections linking national transmission networks, the Agency understands that its principle is equally applicable to any border between two network areas as referred to in point 1.7 of the Guidelines. Thus, such border would be considered as structurally congested when it cannot accommodate all physical flows resulting from the trade requested by market participants, because these trade requests would result in physical flows over network elements which are structurally (physically) congested.

two is called Unscheduled Flows (“UFs”)<sup>10</sup>. They arise from the fact that electricity flows do not necessarily follow contractual paths.

- (36) Figure 1 shows the volume of UFs<sup>11</sup> in different parts of Central Europe and compares them with UFs in other EU regions. It shows, in particular, that the absolute levels of UFs in the CEE region are the largest across the Central-South (“CSE”), Central-West (“CWE”) and the CEE regions<sup>12</sup>.

**Figure 1: Sum of hourly absolute UFs per border in the CEE, CSE and CWE regions – 2011 to 2014 (TWh)**



Source: Vulcanus (2015) and ACER calculations.

Note: The unscheduled flows are calculated with an hourly frequency; the absolute values are then summed across the hours and aggregated for borders belonging to the relevant regions. Furthermore, each pair of country codes in the bar reads as “from – to”, e.g. PL-SK reads as flows from Poland to Slovakia.

<sup>10</sup> There are two origins of UFs. The first origin is the electricity exchanges inside a bidding zone, which are partly realised through other bidding zones. These are called Loop Flows (“LFs”). The second source are the electricity exchanges across bidding zone borders where capacity allocation is not coordinated with the capacity allocation on bidding zone border where the unscheduled flow is observed. These are called Unscheduled Transit Flows (“UTFs”). While LFs are inherent to a zonal market design and depend on the configuration of bidding zones and physical properties of the network, UTFs can be avoided with coordinated capacity allocation such as flow-based market coupling. The UFs may, depending on their magnitude, have an impact on the overall market efficiency and network security.

<sup>11</sup> Since its establishment, the Agency has been monitoring the development of unscheduled flows in Central Europe in the framework of its annual MMRs activity, see:

[http://www.acer.europa.eu/Official\\_documents/Acts\\_of\\_the\\_Agency/Publication/ACER%20Market%20Monitoring%20Report%202013.pdf](http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202013.pdf), p. 93 to 109 and

[http://www.acer.europa.eu/Official\\_documents/Acts\\_of\\_the\\_Agency/Publication/ACER\\_Market\\_Monitoring\\_Report\\_2014.pdf](http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER_Market_Monitoring_Report_2014.pdf), p. 147 to 162.

<sup>12</sup> The number of borders in a region differs as shown in Figure 1 and this may affect the level of UFs reported per region. More borders in a region implicitly mean smaller bidding zones and lower levels of UFs. On the other hand, more borders may also imply higher levels of UFs as it could sum the ‘same’ UFs across borders in a region, which results in double counting.

- (37) UFs pose a challenge for TSOs. First, as TSOs cannot control UFs with capacity allocation, they tend to reduce the capacity available for cross-border trade in order to ensure that the total physical flow on some network elements remains within security limits. This reduction in cross-border capacities usually leads to a loss of social welfare, which corresponds to the foregone social welfare with respect to the situation in which this cross-border capacity were available for cross-border trade (see Figure 3).
- (38) Second, due to UFs, TSOs have to continue applying (more) remedial actions (bearing higher costs) in order to ensure secure grid operation in the TSOs' own networks, i.e. control areas, while transporting 'foreign' electricity flows. This impacts network security and efficiency of the market in general, and may induce significant re-dispatching, counter-trading and curtailment costs.
- (39) As highlighted by the Agency since 2012<sup>13</sup>, these UFs significantly impact both the market efficiency and the security of the network, in particular in the CEE region. The most noticeable (direct and indirect) impacts of UFs on the market efficiency and network security are:
  - (a) An overall lack of progress since 2006 in the implementation of the target model in the CEE region, mainly due to a disagreement between the concerned parties regarding the best way to handle these UFs;
  - (b) A significant reduction in cross-border capacities, in particular on the German-Polish border (see Figure 2), due to the reservation of physical capacity of transmission lines on some borders for transporting electricity (physical flows) as a result of cross-border trade on other borders (UTFs) or of electricity exchanges within foreign bidding zones (LFs)<sup>14</sup>, and an associated increase in the estimated loss of social welfare;
  - (c) The occurrence of N-1 violations on the Polish network due to UFs (see Figure 4)<sup>15</sup>; and
  - (d) The presence of several structural congestions in the CEE network (see Figure 5).

#### 5.4 Impact of Unscheduled Flows on NTC and social welfare

- (40) Table 1 presents the annual average of hourly NTC values for the period 2011 to 2014 (in MWs and as percentage variations between 2011 and 2014) for the CEE, CSE and CWE regions. In 2014, 13 out of 20 borders (each MS border has two directions of trade) in the CEE region recorded decreasing NTC values whereas in 2013 this occurred in 9 out of 20 borders. The changes in the cross-border capacities available for trade can be associated with the increasing levels of UFs. There are however many factors affecting NTC values

<sup>13</sup> See footnote 11.

<sup>14</sup> See footnote 4 for the definitions of UTFs and LFs.

<sup>15</sup> The information on N-1 violations and the underlying cause is provided by the respective NRAs/TSOs.

and it would require a more extensive analysis to assess to what extent UFs reduce NTC values for each border.

**Table 1: Annual average NTC values by border in the CEE, CSE and CWE regions – 2011 to 2014 (MW and the 2011–2014 percentage variation)**

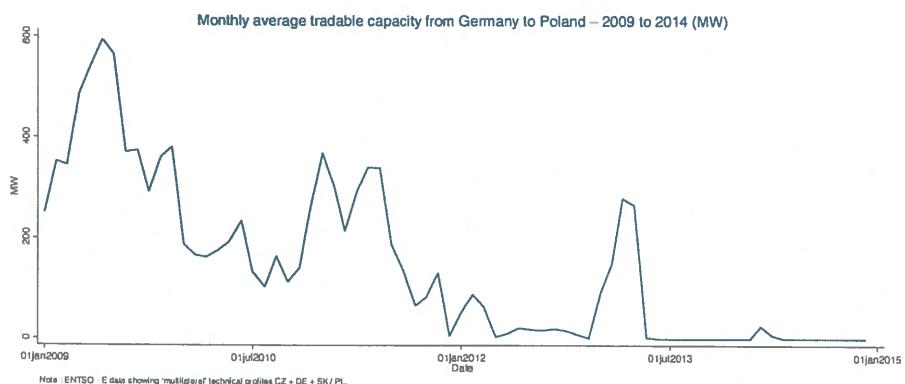
CEE						CSE					
Border	2011	2012	2013	2014	2014/2011	Border	2011	2012	2013	2014	2014/2011
<b>AT&gt;CZ</b>	748	851	663	620	-17%	<b>CH&gt;AT</b>	1,197	1,190	1,193	1,193	0%
<b>AT&gt;HU</b>	749	766	519	514	-31%	<b>CH&gt;DE</b>	3,933	3,989	4,000	4,000	2%
<b>AT&gt;SI</b>	857	930	771	685	-20%	<b>CH&gt;FR</b>	1,103	1,101	1,103	1,108	0%
<b>CZ+PL&gt;DE1</b>	1,170	1,300	1,261	1,361	16%	<b>CH&gt;IT</b>	3,034	2,819	2,766	2,549	-16%
<b>CZ&gt;AT</b>	774	768	559	586	-24%	<b>DE&gt;CH</b>	1,097	891	966	1,094	0%
<b>CZ&gt;DE2</b>	1,266	1,380	1,558	1,361	8%	<b>FR&gt;CH</b>	3,116	3,114	3,068	3,093	-1%
<b>CZ&gt;PL</b>	600	600	600	600	0%	<b>FR&gt;IT</b>	1,926	1,849	1,989	2,267	18%
<b>CZ&gt;SK</b>	1,714	1,615	1,634	1,672	-2%	<b>GR&gt;IT</b>	311	462	295	224	-28%
<b>PLin</b>	197	28	65	3	-99%	<b>IT&gt;AT</b>	79	85	102	96	22%
<b>DE1&gt;CZ+PL</b>	563	601	666	661	17%	<b>IT&gt;CH</b>	1,709	1,718	1,722	1,717	0%
<b>DE2&gt;CZ</b>	563	601	666	661	17%	<b>IT&gt;FR</b>	1,019	1,020	1,020	1,021	0%
<b>HU&gt;AT</b>	783	775	598	599	-24%	<b>IT&gt;GR</b>	311	464	294	224	-28%
<b>HU&gt;SK</b>	766	527	796	761	-1%	<b>IT&gt;SI</b>	153	153	153	649	324%
<b>PL&gt;CZ</b>	568	588	606	633	11%	<b>SI&gt;IT</b>	484	463	442	488	1%
<b>PLout</b>	1,277	1,316	1,273	809	-37%	CWE					
<b>PL&gt;SK</b>	517	509	533	504	-3%	<b>BE&gt;FR</b>	1,420	1,645	1,456	1,361	-4%
<b>SI&gt;AT</b>	901	951	883	946	5%	<b>BE&gt;NL</b>	1,370	1,321	1,359	1,336	-2%
<b>SK&gt;CZ</b>	1,192	1,200	1,197	1,187	0%	<b>DE&gt;FR</b>	2,593	2,596	2,556	2,472	-5%
<b>SK&gt;HU</b>	1,181	1,132	1,140	1,096	-7%	<b>DE&gt;NL</b>	2,313	2,270	2,218	2,231	-4%
<b>SK&gt;PL</b>	460	457	484	463	1%	<b>FR&gt;BE</b>	2,880	2,899	2,580	2,321	-19%
<b>CSE</b>						<b>FR&gt;DE</b>	2,116	1,795	1,785	1,798	-15%
<b>AT&gt;CH</b>	311	455	514	612	97%	<b>NL&gt;BE</b>	1,370	1,333	1,341	1,240	-9%
<b>AT&gt;IT</b>	171	174	230	217	27%	<b>NL&gt;DE</b>	2,292	2,308	2,290	2,257	-2%

Source: CAO Central Allocation Office GmbH (2015), ENTSO-E (2015) and ACER calculations.

Note: DE1 = 50HzT, DE2 = TennetDE. PLout = PL>DE+CZ+SK, PLin = DE+CZ+SK>PL. PLin represents the maximum potential tradable capacity from Germany to Poland. Annual average values are calculated on the basis of hourly data. When ENTSO-E is referenced as a data source for the figures in this Opinion, the ENTSO-E data was retrieved through Energy Market Observatory (EMOS).

- (41) The Polish TSO confirmed that UFs were reducing the cross-border trading capacity made available on the DE-PL border. Figure 2 shows that the monthly average tradable capacity from Germany to Poland over the last five years. It illustrates that this tradable capacity has been declining since 2009 and has settled at around 0 since mid-2013<sup>16,17</sup>.

**Figure 2: Monthly average tradable capacity from Germany to Poland – 2009 to 2014 (MW)**



Source: ENTSO-E (2015) and ACER calculations.

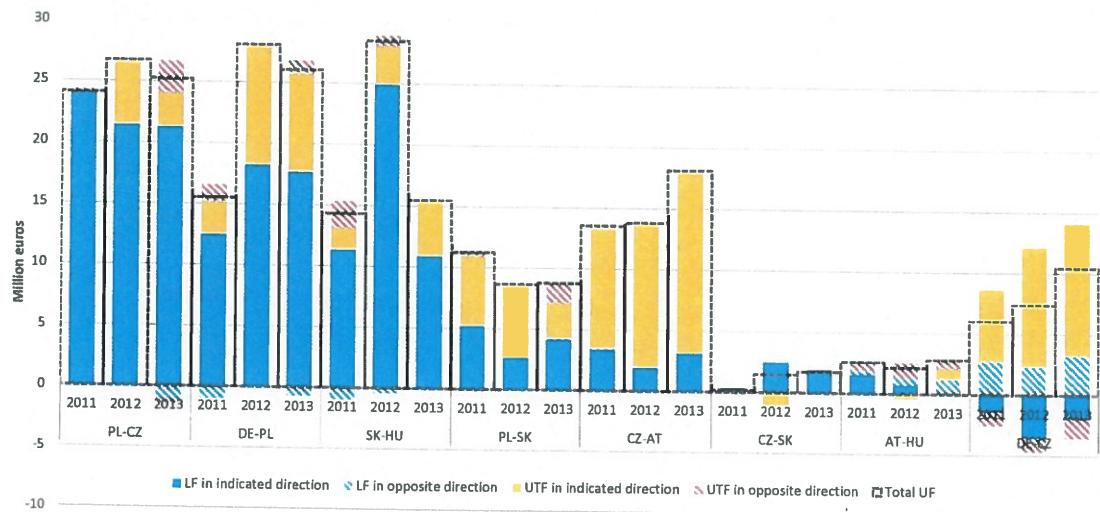
Note: The presented values in the Figure are monthly averages of PLin, as defined in the Note to Table 1.

- (42) Figure 3 shows the welfare loss in the CEE region due to UFs, subdivided in UTFs and LFs. In 2013, the total UF-based welfare losses reached 469 million euro and showed an increase of 1.6% compared to 2012, and of 44.7% compared to 2011. The total losses on the borders in the CEE region amounted to 87.5, 116.7, and 108.6 million euro, respectively, in 2011, 2012 and 2013. These should be considered conservative estimates based only on the welfare losses at the borders. They do not represent the total welfare losses resulting from suboptimal bidding zone configuration. Such an estimate could only be made by conducting a comprehensive review of bidding zones.

<sup>16</sup> The punctual increase in the values observed in 2013 can be attributed to the pilot project on virtual Phase Shifting Transformers (see further below).

<sup>17</sup> In 2014, this border recorded a tradable capacity equal to 0 for 8,536 hours.

**Figure 3: The estimated loss of social welfare due to unscheduled flows in the CEE region – 2011 to 2013 (million euros)**



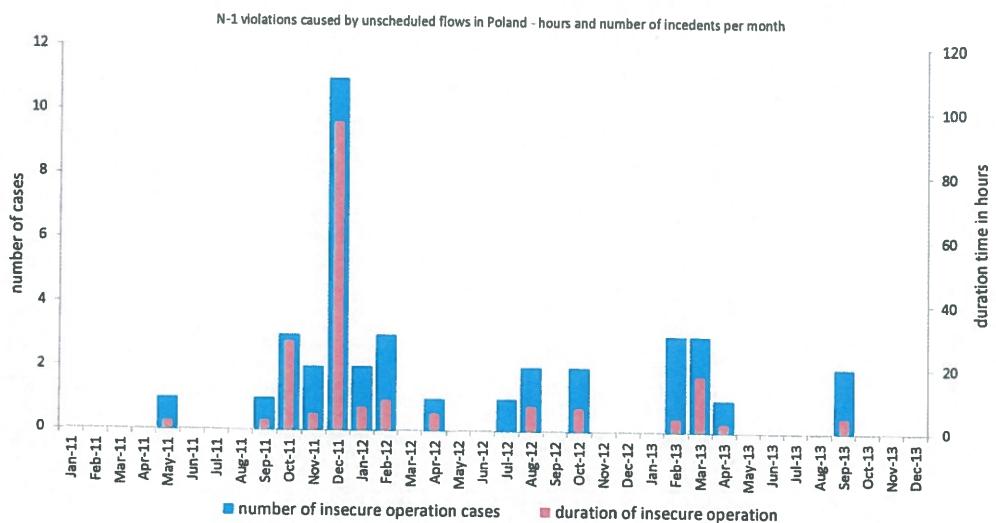
Source: ENTSO-E, Vulcanus, EMOS (2014) and ACER calculations.

Note: The German-Austrian border is omitted, as Austria and Germany form a single bidding zone and have one common price reference. The German-Czech border uses one aggregated value of flows not resulting from capacity allocation for both of its interconnectors. LFs and UTFs then partially offset one another in volumes and thereby the presented result cannot be meaningfully interpreted. Data for 2014 is not available.

## 5.5 Network security

- (43) The increasing amount of UFs endangers network security. One way of measuring this is through the observation of N-1 violations. The number of N-1 violations in the Polish network and their duration are shown in Figure 4. The number of N-1 violations during real time diminished after the end of 2011. This may suggest that remedial measures were applied by the Polish TSO (possibly in coordination with other TSOs) in the planning phase to prevent N-1 violations or during the operational phase (e.g. with redispatching).

**Figure 4: Number and duration of N-1 violations in the Polish network due to unscheduled flows – 2011 to 2013**



Source: URE (2014).

Note: The N-1 violations presented in this Figure are provided by NRAs and were reported to be caused by unscheduled flows. Moreover, it shows only N-1 violations which occurred in real time, i.e. N-1 violations during the planning stage are not included.

- (44) In March 2012, an ENTSO-E briefing paper on interconnected system operation conditions in Continental Central Europe<sup>18</sup> alerted the European Commission on the severity of the situation, in particular in the CEE region, and on the threats that such a situation could imply for network security:
- (a) “Recent developments in the electricity sector have significantly affected system operation conditions on the Continent, especially in central-European countries. Some TSOs increasingly face a situation in which operational measures, to keep the system in normal operational conditions, are exhausted. Due to characteristics of the synchronous system, this potentially threatens the security in the wider areas and ultimately the need to use emergency measures such as load shedding with direct impact on consumers.”
  - (b) “The current power production from RES especially from wind generation in Northern Germany, Denmark, and North Sea and Baltic Sea regions is physically transported by the German internal grid and also in large extent by parallel flows via transmission systems of neighbouring countries to the Southern parts of Germany, to the Alps or

<sup>18</sup> See:

[https://www.entsoe.eu/fileadmin/user\\_upload/library/news/Briefing\\_paper\\_to\\_EC/120416\\_Briefing\\_Paper\\_TO\\_EC\\_ENTSO-E\\_assessemnt\\_interconnected\\_system\\_operation\\_in\\_CCE.pdf#search=briefing%20paper%20interconnection](https://www.entsoe.eu/fileadmin/user_upload/library/news/Briefing_paper_to_EC/120416_Briefing_Paper_TO_EC_ENTSO-E_assessemnt_interconnected_system_operation_in_CCE.pdf#search=briefing%20paper%20interconnection).

*even the Southern parts of the Continent. The limited predictability of these large flows has on occasion caused non-compliance with fundamental grid operational security criteria in parts of the Central Continental European region. Transmission lines overloading or (n-1) violations in parts of the network which endanger the network have been increasingly reported by TSOs.”*

- (c) *“On several borders the difference between physical and scheduled flows is of such magnitude that they are often in opposite directions. This is observed more than 90% of the time on PL/DE border, more than 90% on PL/CZ and more than 80% on PL/SK border. Heavy ‘unplanned’ transit flows added to scheduled flows cause severe loading on southern interconnectors (PL/CZ, PL/SK, DE/CZ, and also SK/HU and SK/UA) and lead to noncompliance with fundamental network security criteria.”*
- (d) *“[...] the security risks observed today are the culmination of the deterioration of the overall system that can be observed by the gradual limitation of the Net Transfer Capacities (NTC) between these countries over recent years. NTC limits have traditionally been one of the tools TSOs utilize under current market rules to manage the increased magnitude of unforeseen physical flows. Clearly this tool is used only when necessary but is nowadays increasingly used due to increased volumes of unforeseen generation intermittency restricting commercially available capacity for market parties.”*
- (e) *“The definition of bidding areas whose borders reflect structural congestions on the grid may also help to solve the issue of unplanned transit-flows. [...] the Central-East Europe region is identified as one where a re-thinking of existing bidding areas in the context of the forthcoming implementation of the market target model by 2014 might be a useful exercise.”*

(45) This alarming situation triggered a series of initiatives aiming to limit or address the impact of UFs in the CEE region, among which:

- (a) The 50Hertz-PSE’s vPSTs pilot project running from January to April 2013, which sought an agreement on the use of remedial actions to limit UFs on the interconnection between the Polish and German electricity systems, to maintain safe operation of these systems and to ensure the availability of cross-border capacities between Germany and Poland of at least 500 MW<sup>19</sup>. In February 2014, a similar vPST agreement was concluded and should remain operational until physical PSTs are installed<sup>20</sup>. All the related costs are shared by the TSOs according to their role (causing or being affected by cross-border power flows). 50Hertz shares its costs with TenneT, another German TSO, and APG, the Austrian TSO;

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<sup>19</sup> See: [http://www.50hertz.com/en/file/20121222\\_PM\\_Phaseschieber\\_EN.pdf](http://www.50hertz.com/en/file/20121222_PM_Phaseschieber_EN.pdf).

<sup>20</sup> Nevertheless, the NTC values on German-Polish border have returned to zero, since according to the polish TSO the experience has shown that the available remedial actions are not sufficient to guarantee a non-zero NTC value.

- (b) The Agency's invitation to ENTSO-E, in August 2012, to initiate an earlier bidding-zone reconfiguration process;
- (c) The Florence Forum's invitation to the Agency and ENTSO-E, in May 2012, to identify an appropriate regulatory framework for cross-border redispatching, including cost-sharing arrangements;
- (d) The joint declaration of the CEE NRAs and the Agency, in March 2012, confirming their will to implement two elements of the target model – i.e. flow-based capacity calculation and day-ahead market coupling – in one single step;
- (e) The progressive strengthening of formal cooperation among TSOs (through the TSC initiative), enabling TSOs from Central Europe to jointly analyse operational security and activate remedial actions; and
- (f) The planned reinforcement of the network, through - in particular - the installation of physical PSTs on several borders of the CEE region; and, more recently, the CEE TSOs' initiative to investigate the effects of the implementation of Flow-Based Market Coupling ("FBMC") with the current bidding zones and the possible options to alleviate the observed risks through security (Security Oriented Option ("SOO"))<sup>21</sup> and/or financial means (Financial Oriented Option).

## 6. ASSESSMENT

(46) In the previous chapter, background facts have been presented with regard to UFs. This chapter aims at assessing whether the DE-AT interconnection is congested within the meaning of Regulation (EC) No 714/2009. The assessment of congestion on the DE-AT interconnection is structured as follows. Section 6.1 identifies structural congestions within the CEE region, which may lead to the need for limiting the DE-AT cross-border exchanges. Section 6.2 provides an in-depth assessment of the relative importance of the DE-AT cross-border exchanges in the CEE region and their impact on the identified structural congestions. Section 6.3 then presents a legal assessment of the lack of capacity allocation procedure on the DE-AT border.

### 6.1 Structural congestions in the CEE region

(47) The identification of structural congestions in this Opinion relies on the analysis performed by ENTSO-E for the first Technical Report for the currently ongoing review of the bidding-zone configuration<sup>22</sup>, published in January 2014, as part of the early implementation of the CACM Guideline. Section 2.3 of that Report addresses the requirements of Article 34(2)(a)

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<sup>21</sup> It is worth emphasizing that the SOO solution considers limiting the flows between Austria and Germany.

<sup>22</sup> See: [https://www.entsoe.eu/news-events/events/Documents/140123\\_Technical\\_Report\\_-\\_Bidding\\_Zones\\_Review\\_Process%20\(2\).pdf#search=technical%20report%20on%20bidding%20zones](https://www.entsoe.eu/news-events/events/Documents/140123_Technical_Report_-_Bidding_Zones_Review_Process%20(2).pdf#search=technical%20report%20on%20bidding%20zones).

of the CACM Guideline on the publication of the location and frequency of structural congestions (i.e. congestions which are unambiguously defined, predictable, geographically stable over time and frequently reoccurring under normal power system conditions)<sup>23</sup> and of major physical congestions. Figure 5 shows areas with structural congestions and major physical congestions as reported in the Technical Report<sup>24</sup>.

**Figure 5: Overview of areas with structural congestions and major physical congestions in Continental Europe – 2011 and 2012**



Source: ENTSO-E, Technical Report Bidding Zones Review Process (January 2014).

Note: The original title to this figure is “Critical/Congested network element clusters: Planning phase (D-1 and D-2 in 2011 and 2012)”.

- (48) In ENTSO-E’s Technical Report, several congested areas are identified in the CEE region, namely the congested areas No. 10, 11, 12, 15, 16, 18, 19, 20, 22 and 23. These congested areas, and the related congested network elements, are further specified in Table 2.

<sup>23</sup> Article 2(19) of the CACM Guideline.

<sup>24</sup> The Agency notes that the technical report suffers from non-harmonised reporting of these congestions and the lack of clarity on how the definition of structural congestion has been applied in this case. For example, the Agency doubts that structural congestions within a bidding zone exist only in Germany. The reported congestions should therefore be understood as structural congestions based on the opinion of TSOs as well as on their individual approaches to transparency.

**Table 2: Reported congested network elements and reasons for congestions – 2011 and 2012**

Congested area No.	Congested network elements	Reason for congestions
10	380 kV line Vieselbach (DE) – Mecklar (DE) 380 kV line Wolmirstedt (DE) – Helmstedt (DE)	Not reported
11	220 kV line Krajnik (PL) – Vierraden (DE) (double) 380 kV line Hagenwerder (DE) – Mikułowa (PL) 400 kV line Mikułowa (PL) – Czarna (PL) 400/220 kV transformers in Mikułowa (PL) 220 kV line Mikułowa (PL) – Świebodzice (PL) 220 kV line Mikułowa (PL) – Cieplice (PL) AT2 400 MVA autotransformer in Krajnik (PL)	High physical flows from 50Hertz to PSE correlated with periods of high generation in the 50Hertz area.
12, 19	Not explicitly specified	High level of physical respectively unscheduled flows from the 50Hertz area to the CEPS area over this border in cases of high transit (respectively loop) flows from north(west) to south(east).
15	220 kV line Liskovec (CZ) – Povazska Bystrica (SK) 400 kV line Nosovice (CZ) – Varin (SK) 220 kV line Kopanina (PL) – Liskovec (CZ) 220 kV line Bujaków (PL) – Liskovec (CZ) 400 kV line Wielopole (PL) – Nosovice (CZ) 400 kV line Iskrzynia (PL) – Lemieszany (SK)	Unscheduled flows and loop flows from the common AT/DE/LU bidding zone.
16	380 kV line Remptendorf (DE) – Redwitz (DE) 380 kV line Vieselbach (DE) - Mecklar (DE)	Not reported.
18	Not explicitly specified	Large and volatile RES feed from the northern part of Germany and the high level of import position in the southern CEE area (APG and MAVIR).
20	380 kV line Slavetice (CZ) – Dürnrohr (AT) (double) 220kV line Sokolnice (CZ) – Bisamberg (AT)	High level of physical resp. unscheduled flows from north to south due to high production in the north of Europe and high load in the south (Hungary, Balkan, Austria and Italy).
22	220 kV line Lehrte (DE) – Mehrum (DE)	Local generation/load patterns
23	220 kV line Obersielach (AT) – Podlog (SI)	Generation/load situation near the border line and import of the Balkan and Italian area.

Source: ENTSO-E (2014).

- (49) The Agency notes that many network elements reported in Table 2 are interconnectors where permanent capacity allocation is currently implemented. Since permanent capacity allocation should not be applied on interconnections which are not usually or structurally congested, these interconnectors should be considered as suffering from structural congestions and not just from major physical congestions.
- (50) Table 3 presents statistics on the application of redispatching within Germany from April 2013 to 19 June 2015.

**Table 3: Application of congestion-related redispatching within Germany**

The origin of the request for redispatching	Number of days (out of 809)	Redispatching volume (GWh)
TenneT DE	615	4,375.8
50Hertz & TenneT DE	266	3,969.2
50Hertz	202	2,024.1
50Hertz & PSE	160	472.9
Other (only within Germany)	64	269.1
Other (on the border or outside Germany)	44	100.5
Total (only within Germany)	652	10638.2

Source: <http://www.netztransparenz.de/de/>

- (51) Table 3 shows that congestion-related redispatching activated at the request of German TSOs only (which indicates a congestion problem within or between German TSO areas) was applied in 652 days (out of 809 days considered in the sample). Most of the redispatching was requested by TenneT Germany alone or in combination with 50HzT. Data on redispatching, presented in Table 3, imply that there are severe structural congestions within Germany.

## 6.2 The DE-AT cross-border exchanges and the congestions in the CEE region

- (52) This section illustrates the relative importance of the DE-AT cross-border exchanges in the CEE region (Section 6.2.1) and assesses their impact on structural congestions in the CEE region, based on the correlation analysis (Section 6.2.2), the discrepancies between cross-border exchanges and physical flows on the DE-AT border (Section 6.2.3) and Power Transfer Distribution Factors (PTDFs) (Section 6.2.4).

### 6.2.1 Importance of the DE-AT cross-border trade in the CEE region

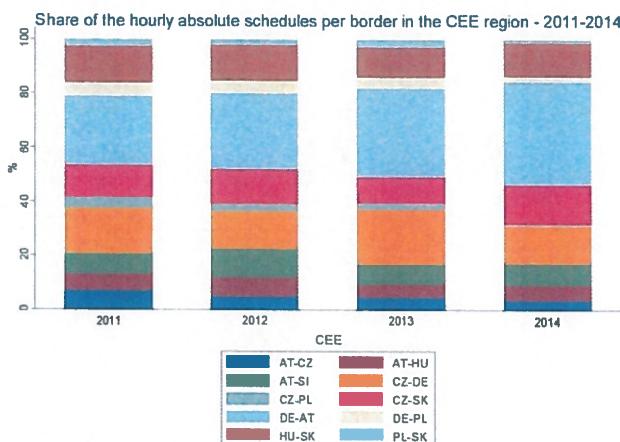
- (53) The single Austrian-German bidding zone (shown geographically in Figure 5) is – in terms of consumption and trade – by far the largest zone in the CEE region. In fact, the total annual power consumption of Austria and Germany was 542.4 TWh in 2013, representing 65.5% of the total annual consumption of the CEE region. Further, Epex Spot, which operates the German-Austrian spot market, reported 262.9 TWh traded on the German-Austrian day-ahead market<sup>25</sup>, whereas EEX power derivatives reported 1,337 TWh traded on the German-Austrian derivatives market<sup>26</sup> in 2014.

<sup>25</sup> See: [https://www.epexspot.com/en/press-media/press/details/press\\_2014\\_power\\_trading\\_volumes\\_grow\\_by\\_10\\_4](https://www.epexspot.com/en/press-media/press/details/press_2014_power_trading_volumes_grow_by_10_4).

<sup>26</sup> See: <http://www.eex.com/blob/83274/321821b768f2ba9c8f923baca2b83d5c/e-eex-markets-and-products-2015-data.pdf>.

- (54) The DE-AT cross-border exchanges, which have been increasing since 2011, represent the highest volume of cross-border exchanges observed in the CEE region. In 2011 and 2014, the cross-border exchanges on the DE-AT border represented 26% and 40% of all cross-border exchanges observed in the region respectively, as illustrated in Figure 6.

**Figure 6: Share of the hourly absolute schedules per border in the CEE region – 2011 to 2014 (percentage)**



Source: Vulcanus (2015) and ACER calculations.

Note: Each border is defined by the country code in the legend, which reads as flows “from – to”, e.g. AT-CZ reads as flows from Austria to the Czech Republic. Unless otherwise indicated in the text, ‘schedules’ presented throughout the document are the ‘realised schedules’, i.e. after intraday trading.

- (55) The distribution of the hourly cross-border exchanges between Germany and Austria shows a wide range of values each year since 2011, as presented in Table 4, and is persistently the largest in the CEE region. For instance, in 2014, the hourly observed DE-AT cross-border exchanges ranged from -3,379 (Min) to 7,126 (Max) MWh, a range 3.3 times higher than the average range across all the CEE region’s borders<sup>27</sup>.

<sup>27</sup> High trade is a desired outcome of market integration provided that it contributes to the overall market efficiency.

**Table 4: Annual hourly averages, standard deviations, minimum and maximum values of cross-border exchanges in the CEE region – 2011 to 2014 (MWh)**

Border	Average				Standard deviation				Min				Max			
	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014
AT>CZ	-429	-326	-286	-164	232	249	212	228	-1,315	-1,298	-850	-1,050	663	712	703	879
AT>HU	149	456	116	348	447	312	346	237	-800	-992	-800	-595	800	810	800	800
AT>SI	422	752	331	481	394	239	436	295	-890	-826	-950	-950	917	952	1,352	1,359
CZ>DE	1,068	982	1,322	793	595	604	580	822	-749	-1,067	-727	-1,400	2998	2,923	2,705	4,866
CZ>PL	-235	-170	-149	-17	222	191	213	82	-770	-750	-900	-674	405	400	785	205
CZ>SK	732	926	584	959	471	387	449	488	-870	-614	-877	-1026	1,896	1,896	2,859	1,908
DE>AT	1,385	1,994	1,789	2,440	1,502	1,189	1,860	1,695	-2,916	-1,649	-3,995	-3,379	5,850	6,209	6,861	7,126
DE>PL	-284	-309	-241	-92	244	270	273	215	-1,240	-1,219	-1,400	-1,600	805	300	900	795
HU>SK	-890	-958	-726	-812	266	264	338	322	-1,300	-1,300	-2,200	-1,100	526	182	790	733
PL>SK	142	136	152	-27	155	151	192	118	-195	-200	-345	-365	600	600	585	520

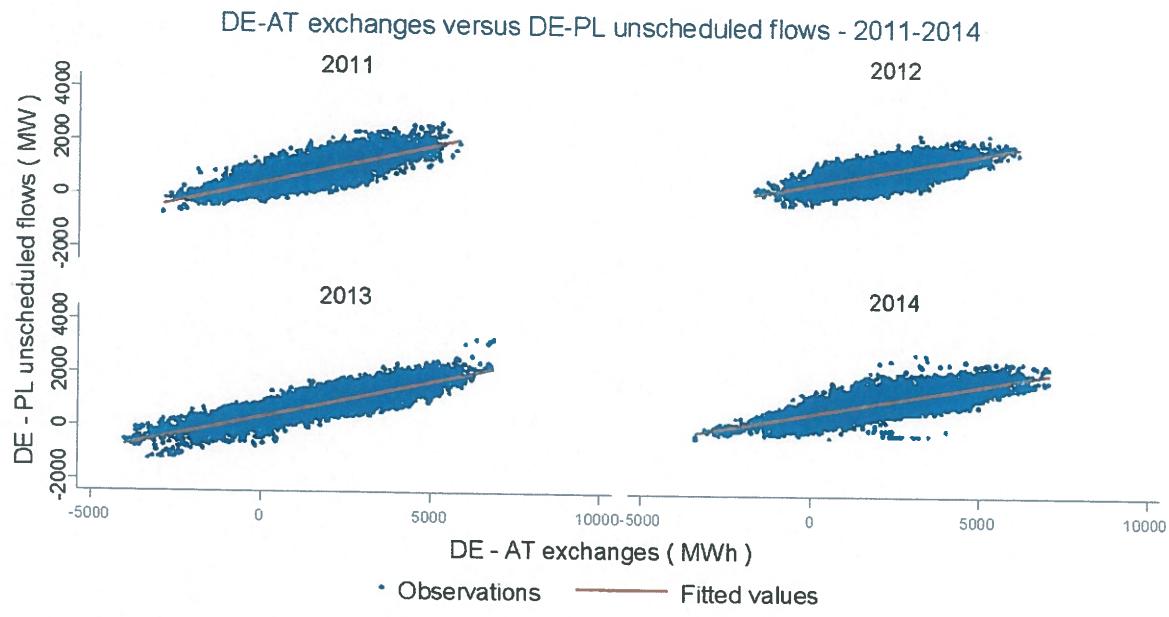
Source: Vulcanus (2015) and ACER calculations.

## 6.2.2 Correlation between DE-AT cross-border exchanges and unscheduled flows in the CEE region

- (56) The extent to which the DE-AT cross-border exchanges interrelate with UFs can be described by their statistical correlation<sup>28</sup>.
- (57) Figure 7 shows the relation between cross-border exchanges on the DE-AT border and UFs on the DE-PL border. Table 5 shows that in 2011, 2012, 2013 and 2014, the (Pearson) correlation coefficient reached 82%, 69%, 88% and 87% respectively. These results are not only statistically significant, but also show to be persistent over the period under consideration.

<sup>28</sup> Correlation is a statistical measure that indicates the extent to which two or more variables fluctuate together. A positive correlation indicates the extent to which those variables increase or decrease in parallel and a negative correlation indicates the extent to which one variable increases as the other decreases. Absolute correlation values of 60% or higher are considered to be meaningful.

**Figure 7: Relation between hourly cross-border exchanges on the DE-AT border and hourly unscheduled flows on the DE-PL border – 2011 to 2014 (MWh)**



Source: Vulcanus (2015) and ACER calculations.

- (58) In addition to the DE-PL border, Table 5 presents correlations between cross-border exchanges on the DE-AT border and UFs on the borders in the CWE, CEE and CSE regions. For instance, the table shows, in the first row, the correlation between cross-border exchanges from Germany to Austria and the UFs on the border from Austria to Slovenia in 2011; this correlation is equal to -72%.
- (59) The results presented in the table show that the most correlated borders lie in the CEE region. For some borders (i.e. AT-CZ, CZ-PL, HU-SK, DE-AT and DE-PL), the correlation is, in absolute value, above 60% for the four years in question. These network components are part of or related to the congested areas indicated with numbers 20 (i.e. AT-CZ), 15 (i.e. CZ-PL), 18 (i.e. HU-SK) and 11 (i.e. DE-PL) in Figure 5. Surprisingly, the DE-CZ border is not within this group of borders, since the correlation in 2012 was below 60%. This could be explained by the fact that physical flows on the border are netted for all interconnectors, whereas in reality the actual physical flows (and consequently the UFs) on individual interconnectors can be much higher than the netted physical flows.

**Table 5: Correlation between scheduled cross-border DE-AT exchanges and unscheduled flows on a selection of borders in the CWE, CEE and CSE regions – 2011 to 2014**

Border	2011	2012	2013	2014	Border	2011	2012	2013	2014
AT->SI	-0.72	-0.38	-0.63	-0.44	DE->AT	-0.87	-0.67	-0.87	-0.84
FR->IT	0.00	-0.21	-0.17	-0.14	CH->FR	-0.20	0.05	-0.04	-0.28
AT->CH	-0.24	-0.02	-0.28	-0.30	DE->FR	-0.04	-0.14	-0.24	-0.28
BE->FR	0.28	-0.03	0.23	0.54	PL->SK	0.73	0.31	0.79	0.63
AT->CZ	-0.89	-0.77	-0.88	-0.89	AT->HU	-0.69	-0.52	-0.74	-0.55
BE->NL	-0.27	0.03	-0.23	-0.54	CH->IT	0.21	0.32	0.37	0.27
CZ->PL	-0.73	-0.60	-0.78	-0.71	DE->NL	0.27	-0.04	0.23	0.54
HU->SK	-0.68	-0.60	-0.66	-0.55	AT->IT	-0.15	-0.30	-0.39	-0.35
CH->DE	-0.12	-0.27	-0.31	0.00	CZ->DE	-0.71	-0.51	-0.68	-0.68
CZ->SK	0.50	0.47	0.43	0.27	DE->PL	0.82	0.69	0.88	0.79
IT->SI	0.41	0.12	0.25	0.13					

Source: Vulcanus (2015) and ACER calculations.

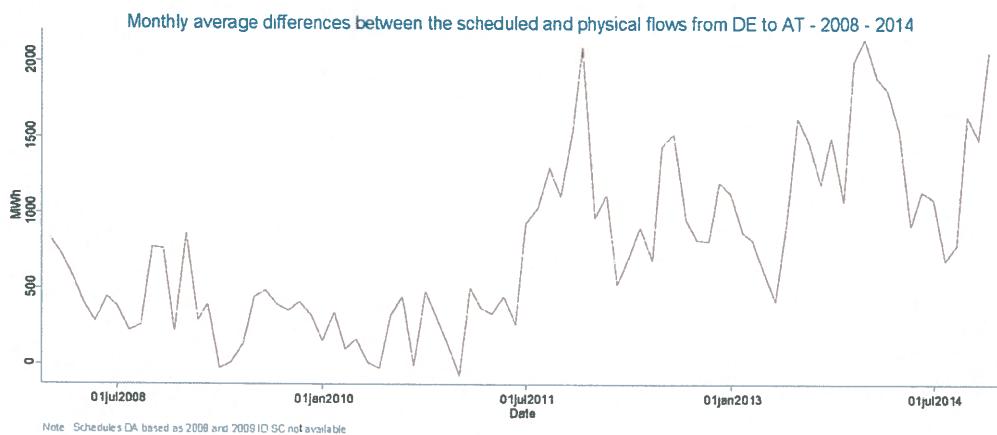
- (60) The correlation analysis suggests a strong (and statistically significant) correlation between the DE-AT cross-border exchanges and UFs on specific borders in the CEE region.
- (61) The next two subsections (Sections 6.2.3 and 6.2.4) provide additional evidence regarding the impact of the DE-AT cross-border exchanges on physical flows and congestion problems on the reported structurally congested network elements.

### 6.2.3 Discrepancy between the cross-border exchanges and the physical flows on the DE-AT border

- (62) This section provides a comparison of the level of physical flows and the level of cross-border exchanges on the DE-AT border as a basis for an assessment of how much of the DE-AT cross-border exchanges are being physically realised through the DE-AT interconnection and how much through other interconnections<sup>29</sup>.
- (63) Since July 2011, the physical flows and the cross-border exchanges on the DE-AT border have diverged significantly. Figure 8 shows the monthly average difference, though it is worth mentioning that - for example - hourly values can be quite volatile and hence exceed average values significantly.

<sup>29</sup> This analysis has the following limitations. The measured physical flows are not a result of the DE-AT cross-border exchanges only. Other cross-border and internal exchanges can cause physical flows on the DE-AT border. Thus, the actual percentage of the DE-AT cross-border exchanges realised through other interconnections may differ from the values calculated in this section.

**Figure 8: Discrepancy between the monthly average scheduled and physical flows on the DE-AT border – 2008 to 2014 (MWh)**



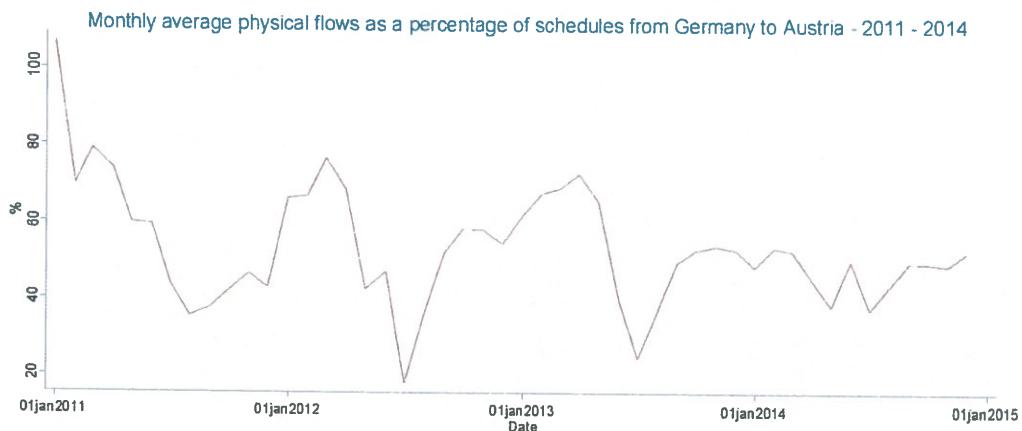
Source: Vulcanus (2015) and ACER calculations.

Note: For this Figure, day-ahead cross-border exchanges instead of intra-day cross-border exchanges have been considered, as the latter are not available prior to 2011.

- (64) Figure 9 shows the monthly averages of the physical flows on the DE-AT border as a percentage of the corresponding monthly averages of the cross-border exchanges from Germany to Austria. Between 2011 and 2014 this percentage ranged from 17.9% to 106.9%<sup>30</sup>. Figure 9 shows that a significant amount of cross-border exchanges on the DE-AT border was often physically flowing through networks in neighbouring countries in the CEE and CWE regions.

<sup>30</sup> Values higher than 100% mean that the physical flow on the border exceeds the cross-border exchange on that border. Percentage value is calculated as the sum of all physical flows divided by the sum of all cross-border exchanges for those hours where the DE-AT cross-border exchanges were positive. The observations with the DE-AT cross-border exchanges close to zero or negative are not included in this analysis as in these cases the percentage values tend to reach extreme values and cannot be interpreted in any meaningful way.

**Figure 9: Monthly average physical flows as a percentage of schedules from Germany to Austria – 2011 to 2014 (percentage)**



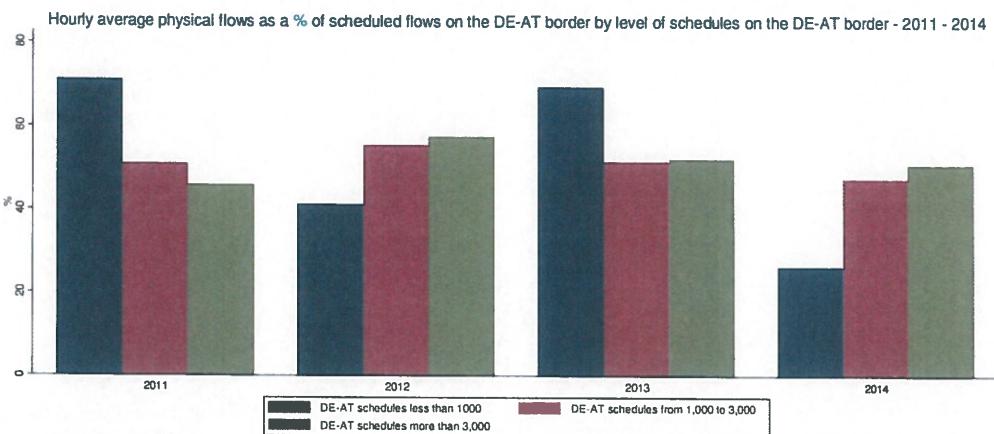
Source: Vulcanus (2015) and ACER calculations.

Note: Only schedules from Germany to Austria, i.e. positive values, are included.

- (65) Figure 10 shows the same percentage as in Figure 9, however averaged for different groups of hourly cross-border exchanges on the DE-AT border. For example, in 2014 during hours when cross-border exchanges from Germany to Austria exceeded 3,000 MW, physical flows on this border accounted for only 50.8% of the DE-AT cross-border exchanges. These percentages vary between the observed years and the groups of DE-AT cross-border exchange levels<sup>31</sup>. Interestingly, Figure 10 does not show a clear relationship between the level of cross-border exchanges and the discrepancy between physical flows and cross-border exchanges (expressed as a percentage).

<sup>31</sup> The group with DE-AT cross-border exchanges between 0 and 1,000 MW has the largest variations, because when cross-border exchanges are low or close to 0, the physical flow can often flow in the opposite direction.

**Figure 10: Hourly average physical flows as a percentage of scheduled flows on the DE-AT border by level of schedules on the DE-AT border – 2011 to 2014 (percentage)**



Source: Vulcanus (2015) and ACER calculations.

Note: Included are schedules from Germany to Austria, i.e. positive values only.

- (66) From 2011 to 2014, on average, only 51.8% of the DE-AT cross-border exchanges were actually physically flowing through the DE-AT border. Based on these findings, it can be concluded that a significant proportion (i.e. 48.2% on average between 2011 and 2014) of cross-border exchanges from Germany to Austria were being realised through neighbouring CEE and CWE networks. Nevertheless, this analysis does not show the extent to which the 48.2% of physical flows are realised through specific borders and structurally congested elements in the CEE region. For this assessment, a more dedicated analysis focusing on specific hours and involving concrete common grid models is required.

#### 6.2.4 Power Transfer Distribution Factors

- (67) According to the CACM Guideline, a PTDF represents the physical flow on a critical network element induced by a variation of the net position of a bidding zone<sup>32</sup>. To calculate how the cross-border exchanges from Germany to Austria influence the flow on a network element of interest, one can calculate the respective PTDF values for Germany and Austria and take the difference between these two values. A simpler approach to calculate this influence is to use a common grid model and to calculate the physical flow on the network

<sup>32</sup> Article 2(22) of Commission Regulation (EU) No 543/2013 of 14 June 2013 on submission and publication of data in electricity markets and amending Annex I to Regulation (EC) No 714/2009 of the European Parliament and of the Council, OJ L 163, 15.6.2013, p. 1.

element in question first. The net position of Germany in the model is then increased by 100 MW and the net position of Austria decreased by 100 MW, which effectively represents a cross-border exchange of 100 MW between Germany and Austria, and the physical flow on the network element in question is calculated again. The difference between this physical flow and the original physical flow represents the PTDF value of cross-border exchanges between Germany and Austria<sup>33</sup>.

- (68) The Agency, as mentioned above, requested URE, ERO and BNetzA to provide data on PTDFs of cross-border exchanges between Germany and Austria for the structurally congested network elements for congested areas No. 10, 11, 12, 16, 19, 20, as specified in Table 2. For this purpose, the Agency provided specific directions to NRAs with regard to the calculation of the PTDF data and with regard to the choice of the Common Grid Model (“CGM”) and Generation Shift Key (“GSK”). The exact directions are described in Annex I to this Opinion, which also provides the PTDF data calculated by the different TSOs and submitted to the Agency by the respective NRAs. The differences in the average PTDF data calculated by the different TSOs are small (i.e. below 1%), though in specific cases the differences are significant (up to 12 %). Where TSOs provided different values of PTDFs for the same network elements (see Annex I), the average value of these PTDFs is presented in Table 6.
- (69) The selected CGMs which TSOs are using for congestion forecasting and planning purposes are presented in the first column of Table 6 where “RGM” refers to Reference Grid Model and “IDCF” refers to Intraday Congestion Forecast model. Cumulative PTDF values are presented for different network elements within the specified congested areas. The PTDF values are specified as a percentage, and thus represent the share of cross-border exchanges on the DE-AT border realised physically through given network elements within specified congested areas. At the bottom of the table, the average and maximum PTDF values taken from the sample of eight CGMs are presented.

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<sup>33</sup> Although PTDF analysis is considered to be the best possible indication of how the commercial exchange between two areas influence physical flows on a specific network element it does have some limitations. These are explained at the end of Annex I to this Opinion.

**Table 6: Cumulative PTDF values for Congested Areas 10, 11, 12, 16, 19 and 20 (in percentage)**

Common Grid Model	Area 10	Area 11	Area 12	Area 16	Area 19	Area 20	DE>PL+CZ
RGM Summer 2013	-10.0	11.8	12.5	10.9	4.0	17.0	28.3
RGM Winter 2014	-11.9	13.6	13.5	8.2	5.7	20.0	32.8
RGM Summer 2014	-12.2	12.3	13.1	9.8	4.6	19.9	29.9
RGM Winter 2015	-12.8	12.1	12.5	11.7	3.9	18.5	28.5
IDCF 20.10.2014 11h	-15.6	13.6	16.3	6.9	9.9	32.4	39.9
IDCF 04.11.2014 09h	-16.7	15.3	21.1	7.2	10.3	36.9	46.7
IDCF 10.12.2014 09h	-18.1	14.3	20.6	4.0	7.5	31.5	42.4
IDCF 24.12.2014 11h	-9.8	11.8	13.9	6.7	2.4	5.8	28.2
Average	-13.4	13.1	15.4	8.2	6.1	22.8	34.6
Maximum	-18.1	15.3	21.1	11.7	10.3	36.9	46.7

Source: URE, ERO and BNetza (2015).

Note 1: Area 10: DE Internal: Vieselbach – Mecklar and Wolmirstedt – Helmstedt; Area 11: DE>PL border: Krajnik – Vierraden and Hagenwerder – Mikułowa; Area 12: DE>CZ border: Rohrsdorf – Hradec; Area 16: DE Internal: Rempendorf – Redwitz; Area 19: DE>CZ border: Etzenricht – Hradec and Etzenricht – Prestice; Area 20: CZ>AT border: Sokolnice – Bisamberg and Slavetice – Durnrohr; DE>PL+CZ: Area 11 + Area 12 + Area 19.

Note 2: The direction indicated in note 1 (e.g. from Vieselbach to Mecklar) also indicates the direction of congestion. A positive PTDF value indicates flow in the congested direction, whereas a negative PTDF value indicates flow in the non-congested direction.

- (70) The results in Table 6 show that on a given sample of CGMs<sup>34</sup>, on average approximately 34.6% of the physical flows resulting from the DE-AT cross-border exchanges are flowing from Germany through congested network elements on the DE-PL and DE-CZ borders, and 22.8% of those flows are flowing back to Austria through congested network elements on the CZ-AT border. In one scenario, 46.7% of the physical flows resulting from the DE-AT cross-border exchanges are flowing from Germany through congested network elements on the DE-PL and the DE-CZ borders and 36.9% of those flows are flowing back to Austria through congested network elements on the CZ-AT border.
- (71) These findings confirm and complement the findings of the previous section showing that a significant share (on average 48.2%) of the DE-AT cross-border exchanges is being realised through the neighbouring CEE and CWE networks. In 2014, the average DE-AT cross-border exchange was 2,440 MW, whereas the maximum was 7,126 MW. Multiplication of these exchange levels with the PTDF values provides the flows that would result from those exchanges. Taking into account the average PTDF values in Table 6, the DE-AT cross-border exchanges cause on average 844 MW of physical flows and a

<sup>34</sup> In the Agency's view the sample size of eight is rather small and therefore the reported average and maximum values should be understood as approximate indication of influences and not accurate representation of the complete sample.

maximum of 2,465 MW of physical flows on the structurally congested lines of the DE-PL and DE-CZ borders, whereas the average and the maximum flows on the structurally congested lines of the CZ-AT border are 555 MW and 1,621 MW respectively. In the Agency's view, this represents a significant impact of the DE-AT cross-border exchanges on the congested network elements on the DE-PL and the DE-CZ borders.

- (72) Furthermore, the results in Table 6 show that the DE-AT cross-border exchanges are also being realised through congested network elements inside Germany. On average, approximately 8.2% of the DE-AT cross-border exchanges are being realised through the structurally congested network element Remptendorf – Redwitz<sup>35</sup>. Taking into account the DE-AT cross-border exchanges in 2014 and the average PTDF values in Table 6, these exchanges caused on average 199 MW of physical flows and a maximum of 581 MW of physical flows on the structurally congested line Remptendorf – Redwitz. In the Agency's view, this represents a significant impact of the DE-AT cross-border exchanges on one of the structurally congested network elements within Germany.

#### **6.2.5 The impact of the DE-AT cross-border exchanges on structural congestions in the CEE region**

- (73) In the Agency's opinion, the results from Sections 6.2.1 to 6.2.4 provide evidence that the cross-border exchanges on the DE-AT border have a significant impact on the structurally congested network elements of the DE-PL, DE-CZ and CZ-AT borders, as well as on structurally congested network elements within Germany.

#### **6.3 The lack of capacity allocation on the DE-AT border**

- (74) The Rules for Coordinated Auction of Transmission Capacity in the CEE Region, which were approved by the NRAs' decisions, do not provide for capacity allocation on the DE-AT border, i.e. for the interconnection between Germany and Austria. In this section we assess the legal basis and the requirements for the implementation of capacity allocation methods on the DE-AT border.

##### **6.3.1 The relevant legal framework**

- (75) The solution of congestion situations and the management and allocation of available transmission capacity of interconnectors is a key concern of Regulation (EC) No 714/2009. This is evident in particular from:

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<sup>35</sup> Approximately 13.4% of the DE-AT cross-border exchanges are also being realised through the structurally congested network elements Mecklar – Vieselbach and Helmstedt – Wolmirstedt, although in the direction opposite to the congestion as indicated by the negative PTDF value. These two lines are congested in the direction from East to West Germany, whereas the physical flows resulting from DE-AT exchanges have a direction from West to East Germany.

- Article 1, indicating fair rules for cross-border exchanges in electricity and enhanced competition within the internal electricity market through, *inter alia*, ‘the allocation of available capacities of interconnections between national transmission systems’ as one of the main aims of the Regulation;
- Article 16, setting out ‘general principles for congestion management’; and
- Annex I, laying down ‘Guidelines on the management and allocation of available transfer capacity of interconnections between national systems’.

- (76) In this context, Regulation (EC) No 714/2009 underlines that coordination among TSOs with regard to the application of congestion management methods is important. This is clear especially from:
- Article 12(2), referring to the TSOs’ duties ‘to promote the coordinated allocation of cross-border capacity through non-discriminatory market-based solutions’; and
  - Point 3 of Annex I, concerning ‘coordination’, and notably point 3.1 and 3.2 referring to common congestion-management methods coordinated between countries and within regions.

- (77) In the Agency’s view, this shows that Regulation (EC) No 714/2009 aims to ensure that congestion problems are addressed in a way which takes into account the physical reality of electricity flows in the European meshed network and the complex interdependency between, on the one hand, the physical flows on one interconnection and the respective concerned national networks and, on the other hand, the available transfer capacity on another interconnection and the respective concerned national networks.

### 6.3.2 The requirement to implement capacity allocation

- (78) Regulation (EC) No 714/2009 and its Guidelines tie the need for capacity allocation to the existence of congestion. Pursuant to point 1.2 of the Guidelines, there need be no capacity allocation procedure for access to a cross-border transmission service where there is usually no congestion; and, pursuant to point 1.4 of the Guidelines, appropriate congestion-management methods and arrangements, defined and agreed upon in advance, shall be implemented immediately by the TSOs if structural congestion appears.
- (79) According to E-Control, the cross-border flows on the DE-AT interconnection are usually below the available transmission capacity of this interconnection. Based on this fact, E-Control infers that the DE-AT interconnection is usually in a position to accommodate all physical flows between Austria and Germany. Therefore, E-Control concludes that the DE-AT interconnection as such cannot be considered as structurally congested and that

Regulation (EC) No 714/2009 and the Guidelines do not impose an obligation to implement a capacity allocation procedure at the DE-AT interconnection.

- (80) However, the capacity of and the flows on an interconnection itself are not the only factors to be considered in deciding whether or not a capacity allocation procedure is required. In fact, as confirmed by the definition of congestion in Article 2(2)(c) of Regulation (EC) No 714/2009, not only the capacity of the interconnectors, but also the capacities of the national networks concerned by physical flows engendered by the cross-border exchanges at a border, have to be taken into account to conclude whether or not an interconnection can accommodate these flows. For instance, if an interconnection could host the relevant flows only at the expense of network security violations or discriminatory access to other interconnectors, it should be considered as, in fact, lacking the capacity necessary to accommodate those flows.
- (81) As shown above, the cross-border exchanges on the DE-AT border are physically realised partly through congested network elements on the DE-PL, DE-CZ and CZ-AT borders, as well as congested network elements within Germany. As such, these cross-border exchanges either lead to the capacity of those network elements being frequently insufficient to accommodate all the flows arising from trade requests having a significant impact on those network elements; or they frequently require remedial actions, such as redispatching or countertrading, to ensure that the flows on those network elements comply with the requirements of network operational security.
- (82) Thus, to the extent that the DE-AT interconnection can carry the scheduled DE-AT cross-border exchanges and the resulting physical flows, it can do so only at the expense of significant limitations of the available cross-border capacity and international trade on other interconnectors, as well as of remedial actions due to congestions on internal network elements as well as on interconnectors. Therefore, in the Agency's view, the direct impact of the exchange on the DE-AT border on the congested DE-PL, DE-CZ and CZ-AT interconnectors, as well as on the congested network elements within Germany, implies that in fact the DE-AT interconnection can usually not accommodate all physical flows resulting from international trade requested by market participants. Therefore, the Agency considers the DE-AT interconnection as usually and structurally congested, pursuant to point 1.2 and 1.4 of the Guidelines in conjunction with Article 2(2)(c) of Regulation (EC) No 714/2009.
- (83) According to E-Control, capacity allocation should be used as a congestion management method only in cases where no other cost-efficient and technically effective measures are available. E-Control however also acknowledges that "only in case of 'structural' congestion, a permanent capacity allocation method has to be implemented".

- (84) The Agency agrees that, in case of structural congestion as defined in Article 2(19) of the CACM Guideline, a permanent capacity allocation method has to be implemented. The Agency considers redispatching and countertrading as less cost-efficient in case of structural congestions, but they might be needed to address structural congestions during the transition period<sup>36</sup>. Whilst point 1.3 of the Guidelines allows curative re-dispatching and countertrading in case lower-cost measures cannot be applied, points 1.2 and 1.4 of the Guidelines do not mention the use of redispatching or countertrading measures to address structural congestion.
- (85) Thus, since the Agency considers the DE-AT interconnection as usually and structurally congested, it deems necessary that capacity allocation methods are implemented on this border, pursuant to Article 2(2) (c) of Regulation (EC) No 714/2009 and points 1.2 and 1.4 of the Guidelines.

### **6.3.3 The requirement to implement a coordinated common capacity allocation procedure**

- (86) Regulation (EC) No 714/2009 and its Guidelines also emphasise the need for a coordinated and common approach to dealing with congestion problems. Pursuant to Article 12(2) of Regulation (EC) No 714/2009, TSOs shall promote operational arrangements in order to ensure the optimal management of the network and shall promote the coordinated allocation of cross-border capacity through non-discriminatory market-based solutions.
- (87) More specifically, pursuant to point 3.1 of the Guidelines, capacity allocation at an interconnection shall be coordinated and implemented using common allocation procedures by the TSOs involved in cases where commercial exchanges between two countries (TSOs) are expected to significantly affect physical flow conditions in any third country. NRAs and TSOs shall ensure that no congestion-management procedure with significant effects on physical electric power flows in other networks is devised unilaterally. Furthermore, point 3.2(d) of the Guidelines requires the application of a common coordinated congestion-management method and procedure for the allocation of capacity to the market at least annually, monthly and day-ahead by 1 January 2007 between the countries in the CEE region, i.e. Germany, Poland, Czech Republic, Slovakia, Hungary, Austria and Slovenia. Moreover, point 3.5 of the Guidelines provides that the coordination between TSOs, with a view of promoting fair and efficient competition and cross-border trade, as well as of securing operation of the network, includes all the steps from capacity calculation and optimisation of allocation.

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<sup>36</sup> The Agency notes that measures such as implementation of capacity allocation requires a certain transition period for stakeholders to prepare, as was done in the Swedish case where this period was set to 18 months. During this period, curative re-dispatching and countertrading might be needed to address structural congestions. For example, in the Swedish case, these measures were applied in such an amount as to mirror the situation after implementation of capacity allocation in Sweden. See paragraph 94; [http://ec.europa.eu/competition/antitrust/cases/dec\\_docs/39351/39351\\_1211\\_8.pdf](http://ec.europa.eu/competition/antitrust/cases/dec_docs/39351/39351_1211_8.pdf).

- (88) These provisions illustrate that Regulation (EC) No 714/2009 understands congestion not as a stand-alone concept which can be evaluated for an interconnection disregarding the physical reality of the surrounding network, but as a phenomenon inherently linked to the other interconnectors and national transmission systems which are affected by the cross-border exchanges on the interconnection concerned. It is the physical reality of electricity flows in the European meshed electricity network that cross-border exchanges on one interconnection can have a significant impact on the physical flows on other interconnections and can cause congestions and reduction in available cross-border capacity there.
- (89) Against this background, the Agency is of the view that the purpose of the coordinated “common congestion management procedure”, referred to in point 3.1 of the Guidelines, is to address the significant (negative) effects which cross-border exchanges scheduled on one interconnection may have on other interconnections. Thus, a common congestion management procedure coordinated by the relevant TSOs is not an end in itself, but should address these (negative) effects effectively. Moreover, in view of the objectives, principles and specific requirements which Regulation (EC) No 714/2009 defines for the management of congestion problems, the common coordinated congestion management procedure should address congestion problems with solutions which (a) are market-based thus enhancing competition, (b) are non-discriminatory, (c) give efficient economic signals to the market participants and transmission system operators involved, and (d) involve transparent congestion-management methods. Those requirements are in particular evident from:
- Article 16(1) of Regulation (EC) No 714/2009, which provides that network congestion problems shall be addressed with non-discriminatory market-based solutions which give efficient economic signals to the market participants and transmission system operators involved;
  - Point 1.5 of the Guidelines, which provides that the methods adopted for congestion management shall give efficient economic signals to market participants and TSOs, promote competition and be suitable for regional and Community-wide application;
  - Point 1.6 of the Guidelines, which provides that a particular request for transmission service shall be denied only when the incremental physical power flows resulting from the acceptance of that request imply that secure operation of the power system may no longer be guaranteed and the monetary value of the request in the congestion-management procedure is lower than all other requests intended to be accepted for the same service and conditions;
  - Point 3.1 of the Guidelines, which requires that, where commercial exchanges between two countries (TSOs) are expected to affect physical flow conditions in any third-country (TSO) significantly, congestion-management methods are coordinated

between all the TSOs so affected through a common congestion-management procedure and that NRAs and TSOs ensure that no congestion-management procedure with significant effects on physical electric power flows in other networks is devised unilaterally;

- Point 5.2 of the Guidelines, which requires TSOs to publish a general description of the congestion-management method applied under different circumstances for maximising the capacity available to the market, and a general scheme for the calculation of the interconnection capacity for the different timeframes, based upon the electrical and physical realities of the network;
  - Point 5.3 of the Guidelines, which requires transparent description of the congestion management and capacity-allocation procedures in use, together with the times and procedures for applying for capacity, a description of the products offered and the obligations and rights of both the TSOs and the party obtaining the capacity, including the liabilities that accrue upon failure to honour obligations.
- (90) E-Control has provided consultancy studies concluding that cross-border exchanges on the DE-AT border do not have a significant impact on congestions in other parts of the CEE network and thus, a capacity allocation procedure on the DE-AT border would not address the congestion problems in the CEE network.
- (91) The Agency notes that these studies did not analyse the impact of a coordinated capacity allocation procedure on the DE-AT border on congestion problems in other parts of the CEE region<sup>37</sup>. Thus in the Agency's opinion, these studies have not demonstrated that a coordinated capacity allocation procedure on the DE-AT border would not address congestion problems. Indeed, the studies provided by E-Control demonstrate that non-coordinated capacity allocation procedure would likely not address congestion problems in the CEE region. Since there are structural congestions on the DE-PL, DE-CZ and CZ-AT interconnectors and since the cross-border exchanges over the DE-AT interconnection have a significant impact on the flow conditions on these interconnectors, point 3.1 of the Guidelines requires a common and coordinated congestion management procedure, involving the DE-AT interconnection and other interconnections in the CEE region, which is transparent, market-based, competition enhancing, non-discriminatory, and which provides for efficient economic signals. The following sections 6.3.3.1 to 6.3.3.4 demonstrate that only coordinated capacity allocation procedure can fulfil these requirements and can adequately address congestion problems in highly-meshed networks (such as the network in the CEE region) where physical congestions are caused not only by cross-border exchange on one border, but by cross-border exchanges on many borders simultaneously.

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<sup>37</sup> The studies focus on bilaterally defined NTC values on the DE-AT border, without clarity on how they have been determined or calculated.

### 6.3.3.1 Market-based congestion management enhancing competition

- (92) Points 1.5 and 1.6 of the Guidelines imply that when TSOs cannot accommodate all requests for cross-border exchanges because the secure operation of the power system would not be guaranteed, they shall deny the requests with the lowest monetary value (i.e. willingness-to-pay for cross-border exchange).
- (93) The presence of structural congestions in the CEE region indicates that TSOs cannot accommodate all the requests for cross-border exchanges which have a significant influence on these structural congestions. This implies that the requests for those cross-border exchanges should be granted or denied using the above competitive and market-based principle, so as to facilitate efficient cross-border trade. It also implies that when a single structural congestion is significantly impacted by the requests for cross-border exchanges on two or more different borders, the monetary value of these requests should be weighed against their relative impact on the structural congestion.
- (94) Currently, the cross-border exchanges on the DE-AT border, while having a significant impact on structural congestions in the CEE region, do not compete for the limited capacity of these congested network elements. The requests for cross-border exchanges on the DE-AT border are accepted unconditionally by the Austrian and German TSOs, even though these exchanges have a significant impact on congested network elements in other parts of the CEE region. As a consequence, the TSOs responsible for keeping the physical flows on these congested network elements within operational security limits are forced to reduce the cross-border capacity available on their CEE borders. In addition, the large uncertainty of cross-border exchanges on the DE-AT border (see Table 4) further reduces the available cross-border capacity on other CEE borders, since the capacity on other CEE borders is calculated before the actual cross-border exchanges on the DE-AT border are known. Thus, the TSOs on other CEE borders need to reduce the cross-border capacities not only for the expected volume of physical flows resulting from the DE-AT exchanges, but also due to the uncertainty of their level (i.e. actual flows may be bigger than the expected ones).
- (95) Therefore the requests for cross-border exchanges on the DE-AT border are systematically accepted without taking into account the actual monetary value of such requests. On other CEE borders, however, the requests for cross-border exchanges are often denied because of limited available cross-border capacity. Thus, the situation where the requests for cross-border exchanges with a lower monetary value (e.g. on the DE-AT border) are being granted whereas the requests for cross-border exchanges with a higher monetary value (e.g. on the DE-PL border) are being denied is not systematically prevented.

- (96) In the Agency's opinion, a market-based congestion management method enhancing competition is currently not applied on the DE-AT interconnection, despite the fact that it is usually and structurally congested.
- (97) In the Agency's view, the inclusion of the DE-AT border in a capacity allocation procedure coordinated within the CEE region, pursuant to points 3.1 and 3.5 of the Guidelines, would be the most appropriate market-based congestion management method enhancing competition, as it would ensure that all requests for cross-border exchanges are granted or denied based on their monetary value weighed against their relative impact on congestion.

#### **6.3.3.2 Congestion management providing efficient economic signals**

- (98) Congestion costs attributed to cross-border exchanges have a direct impact on the wholesale electricity price formation in different areas as they impact the price at which electricity can be imported to, or exported from, different areas. To ensure correct economic signals, cross-border exchanges and related congestion management methods need to reflect the costs of all congestions which those cross-border exchanges cause.
- (99) Currently, the requests for cross-border exchanges on the DE-AT border are being accepted assuming no costs from congestions in other parts of the CEE network, while the requests for cross-border exchanges on other CEE borders are being granted or denied by attributing disproportionately higher costs of congestions to those cross-border exchanges. The absence of congestion costs for exchanges on the DE-AT border results in a misleadingly equal wholesale market price in the whole of Germany and Austria, whereas the presence of (high) congestion costs on other CEE borders results in relatively high differences in wholesale market prices in other parts of the CEE region (e.g. between Germany and Poland).
- (100) Such inadequate representation and allocation of congestion costs distorts the wholesale market price signals. As a result, investment signals for generation, consumption and network reinforcements are distorted and do not provide correct signals for investments, as well as adequate locational information on where these investments are needed.
- (101) In the Agency's opinion, the DE-AT interconnection, whilst being usually and structurally congested, is currently not subject to a congestion management method providing efficient economic signals.
- (102) In the Agency's view, the inclusion of the DE-AT border in a capacity allocation procedure coordinated within the CEE region, pursuant to points 3.1 and 3.5 of the Guidelines, would be the most appropriate and most efficient congestion management method providing efficient economic signals, considering that a coordinated capacity allocation procedure

would allocate congestion costs to cross-border exchanges proportionately to their contribution to the congestion.

### 6.3.3.3 Non-discriminatory congestion management

- (103) The capacity of interconnectors is calculated at a point in time when the precise exchanges outside the capacity allocation procedures are not yet known. Therefore, the total capacity of the relevant network elements is actually reduced for:
- The expected physical flows resulting from the expected exchanges outside the capacity allocation procedures;
  - The reliability margin, representing the reduction in cross-border capacity to cover the uncertainties within the capacity calculation, most notably the uncertainty of the expected physical flows resulting from the expected exchanges outside the capacity allocation procedures.
- (104) The cross-border capacities available on CEE borders other than on the DE-AT border represent the capacities of the congested network elements, which are reduced, *inter alia*, by the amount of physical flows resulting from expected exchanges on the DE-AT border and by the reliability margin associated with the uncertainty of these exchanges. This *de facto* provides a priority right for cross-border exchanges on the DE-AT border to use the capacities of the congested network elements at the expense of cross-border exchanges on other CEE borders, as these can only use the portion of the capacities of congested network elements which has not already been used by the cross-border exchanges on the DE-AT border. This results in discrimination among network users on different interconnections (i.e. borders) who want access to scarce transmission capacities in the CEE region. In particular, it results in discrimination between market participants requesting cross-border exchanges on the DE-AT border and market participants requesting cross-border exchanges on other CEE borders: while the requests of the former are never denied, the request of the latter are denied frequently, *inter alia*, as a direct consequence of the (acceptance of) the requests of the former.
- (105) In the Agency's view, the inclusion of the DE-AT border into a capacity allocation procedure coordinated within the CEE region, pursuant to points 3.1 and 3.5 of the Guidelines, would be the most appropriate and the most efficient way of remedying this discriminatory situation, as a coordinated capacity allocation procedure would accept or reject requests for cross-border exchanges in a non-discriminatory manner, based on their monetary value and their relative impact on congested network elements and would not be based on country of origin of the requests as it is currently the case.

### 6.3.3.4 Transparent congestion management

- (106) Point 5.2 of the Guidelines requires that TSOs “*...publish a general description of the congestion-management method applied under different circumstances for maximising the capacity available to the market, and a general scheme for the calculation of the interconnection capacity for the different timeframes, based upon the electrical and physical realities of the network.*” The transparency of a congestion management procedure, including the coordinated capacity allocation procedure, essentially addresses three questions that are of interest to network users and the general public:
1. Which network elements are congested and are limiting the cross-border exchanges and trade?
  2. How is the capacity of these network elements calculated?
  3. How is the scarce capacity of these network elements allocated to the requests for cross-border exchanges?
- (107) The application of coordinated capacity allocation procedures, as described in Chapter 3 of the Guidelines, does require TSOs to disclose information related to these three questions. This ensures that the coordinated capacity allocation procedure is based on objectively defined physical properties of the network and the monetary value of the requests for cross-border exchanges.
- (108) The DE-AT interconnection, whilst being, in the Agency’s opinion, usually and structurally congested, currently does not apply a transparent congestion management method. The impact of cross-border exchanges on the DE-AT border on congestion problems in the CEE region seems to be implicitly acknowledged by the Austrian and German TSOs, which actively participate in solving congestion problems in the CEE region. This participation mostly involves coordinated remedial actions, namely coordinated redispatching through the vPST arrangements aiming at ensuring network security, as well as some minimum cross-border capacity on the DE-PL border. Nevertheless, the NTC values on the DE-PL border have returned to zero, as the experience has shown that the available remedial actions are not sufficient to guarantee a non-zero NTC value. In spite of these arrangements, the Agency notes that the methodology for solving congestion problems and calculating cross-border capacity on the DE-PL border is not transparently described by the involved TSOs and does not address the three questions outlined above.
- (109) The Agency also notes that cross-border exchanges on the DE-AT border in the intraday timeframe are being blocked during significant time periods, even though the very notion of a bidding zone does not allow any restrictions to trade within its borders (i.e. trade can be restricted only with capacity allocation). During the first half of 2015, intraday trade on

the DE-AT interconnection was stopped before the intraday gate closure time during 67 days (which accounts for 35.8% of days in the observed period). The reason for applying this measure, as reported by APG<sup>38</sup>, is most often the critical level of load flows, although the exact location of congestion problems is not reported. This raises significant concerns with regard to the transparency of congestion management on the DE-AT interconnection.

- (110) In the Agency's view, the inclusion of the DE-AT border into a capacity allocation procedure coordinated within the CEE region pursuant to points 3.1 and 3.5 of the Guidelines would be the most transparent congestion management method, as it would make the information available on a) the network elements which are congested and are limiting the cross-border exchanges and trade, b) how the capacity of these network elements is calculated and c) how the scarce capacity of these network elements is allocated to the requests for cross-border exchanges.

#### **6.3.3.5 Coordination of capacity calculation and allocation**

- (111) In the previous sections of this Opinion, the Agency has demonstrated that cross-border exchanges on the DE-AT border have a significant impact on structurally congested interconnectors and network elements located in the CEE region and, therefore, the capacity calculation and allocation on the DE-AT border should be coordinated within the CEE region, as defined in point 3.2 of the Guidelines.
- (112) Point 3.5 of the Guidelines requires that "*coordination between TSOs within the regions set out in point 3.2 shall include all the steps from capacity calculation and optimisation of allocation to secure operation of the network, with clear assignments of responsibility*".
- (113) With regard to this requirement, the Agency is of the view that the capacity calculation and allocation on the DE-AT border should be coordinated within the CEE region in such a way that the DE-AT border forms a constituent part of the CEE region for the application of coordinated capacity calculation, optimisation of allocation and secure operation of the network.

#### **6.3.4 Alternatives to a coordinated common capacity allocation procedure**

- (114) E-Control and BNetzA refer to mitigating measures, notably redispatching, network investments and the bidding zone review process under the CACM Guideline, as more appropriate solutions for the congestion problems in the CEE region.

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<sup>38</sup> See publications on current market information at <http://www.apg.at/en/market/cross-border-exchange/REMIT>

- (115) As indicated above, the Agency considers redispatching and countertrading as less cost-efficient in case of structural congestions, though they might be needed to address structural congestions during the transition period<sup>39</sup>. In fact, as already recalled above, Regulation (EC) No 714/2009 requires that structural congestions are addressed with a coordinated congestion management procedure that should address congestion problems with solutions which (a) are market-based, thus enhance competition, (b) are non-discriminatory, (c) give efficient economic signals to the market participants and transmission system operators involved, and (d) involve transparent congestion management methods.
- (116) Among the envisaged measures to limit the negative impact of the DE-AT cross-border exchanges on the physical flows of congested network elements and on available cross-border capacities on other CEE borders is the so called SOO, which introduces an artificial limit to the cross-border exchanges on the DE-AT border that is applied in the capacity calculation process, but not in reality (e.g. day-ahead or intraday market coupling). In the Agency's understanding, such limit would indeed increase cross-border capacity on other borders at times when the expected volume of cross-border exchanges on the DE-AT border exceed this limit, but would also result in significant violations of operational security, thereby leading to a significant increase in the use of remedial actions.
- (117) Regarding network investments, the Agency notes the significant efforts and plans of the involved parties to strengthen the network and, thereby, to contribute to mitigate the congestion problems in the CEE region. However, the Agency does not consider these planned network investments as a sufficient reason for not introducing a coordinated capacity allocation procedure on the DE-AT border<sup>40</sup>. Firstly, the Agency considers the network development as a long-term measure, whereas the evolution of network congestions is often a much more dynamic process (for example due to unanticipated and rapid changes in the generation and load patterns) requiring actions in the short- to mid-term timeframe. Secondly, the Agency notes that, in highly meshed AC networks such as Central Europe, investments inside one bidding zone might mitigate congestions in such bidding zone, but it does not guarantee that exchanges inside this bidding zone will no longer cause congestions in another bidding zone due to loop flows. Finally, the Agency notes that such a long-term solution will, by no means, solve the immediate issue at stake (i.e. a lack of compliance of some NRAs' decisions with the provisions of the Guidelines and of Regulation (EC) No 714/2009).
- (118) The bidding zone review under the CACM Guideline is indeed an important project. However, in the Agency's view, this review does not constitute a prerequisite for

<sup>39</sup> See paragraph 84.

<sup>40</sup> According to information provided to the Agency by BNetzA, the German network development plans are based on the assumption that a certain restriction in trade between Germany and Austria is in place. Therefore, the planned network development will naturally only suffice to accommodate the trade of such quantity.

reconfigurations of bidding zones which are necessitated by the congestion management requirements of Regulation (EC) No 714/2009, and accordingly, the fact that it has not yet delivered its conclusions does not justify non-compliance with the congestion management requirements of Regulation (EC) No 714/2009. Thus, the Agency deems it necessary that compliance with the legal requirements of capacity allocation for congested interconnections is ensured through the implementation of capacity allocation on the DE-AT interconnection as soon as possible and not only once a bidding zone review under the CACM Guideline has been completed.

- (119) The Agency does still consider the review of bidding zones which has been initiated in the frame of the early implementation of the CACM Guideline as an important early attempt to define efficient and optimal bidding zones in Central Europe, and will therefore continue to focus on it. The outcome of this ongoing review may also be relevant for the issue which is considered in this Opinion. It is also to note that the review's potential to solve the congestion problems in the CEE region is uncertain, since the review envisages a decision-making process which requires consensus among all the involved Member States without a specified dispute resolution process; it is in particular uncertain if and when this review will produce a final result, which would address the imminent congestion problems which are considered in this Opinion. Besides, it is to note that in the ongoing bidding-zone review, all the scenarios of alternative bidding-zone configurations currently being considered and aiming to address congestion problems also in the CEE region<sup>41</sup> do in fact include the DE-AT border as a bidding zone border and hence imply capacity allocation methods on that border, i.e. the DE-AT interconnection.
- (120) For all these reasons, the Agency considers the implementation of a coordinated capacity allocation procedure on the DE-AT border as soon as possible as an important and necessary measure to address the congestion problems considered in this Opinion, even though such procedure will not solve all the congestion problems in the CEE region. In particular the increasing amount of north-to-south exchanges within Germany causes severe structural physical congestions within Germany and in the neighbouring countries and this indicates that additional measures would also be needed. While this issue falls outside the scope of this Opinion, the Agency recommends that this issue be further investigated and seriously addressed in a coordinated way, i.e. in the framework of the bidding zone review process or in any other appropriate framework.

### **6.3.5 Coordinated capacity allocation procedure on the DE-AT border with respect to other elements of market efficiency and Articles 34, 35, 101 and 102 TFEU**

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<sup>41</sup> The Agency notes that there is also one scenario under review which suggests merging smaller bidding zones and in which the Austrian-German bidding zone is maintained. However, this scenario does not have the potential to solve the congestion problems in the CEE region.

- (121) E-Control argues that capacity allocation on the DE-AT border could have a detrimental effect on the functioning of the electricity market in Austria and Germany, as it could affect market liquidity, market power or retail market competition.
- (122) With regard to retail market competition, the Agency's MMR from 2013 reported on the influence of the introduction of bidding zones in Sweden on retail market competition. The report concludes that “*...there is no clear evidence that retail market competition in Sweden decreased following the introduction of bidding zones in 2011. Both the number of retailers and the margins are roughly the same as prior to the reform. Furthermore, all retailers that Ei interviewed emphasised that the reform had not hampered retail competition*”. Therefore, the experience in Sweden does not support E-Control’s concerns with regard to retail market competition.
- (123) The impact of bidding zone reconfiguration on market liquidity and market power has to some extent been analysed by the Agency in its Report on the influence of existing bidding zones on electricity markets, published in 2014<sup>42</sup>. With respect to market power, the report concludes that the possible changes to the bidding zone configuration should not be primarily guided by possible impacts on market power, since market power is primarily impacted by market structure and market concentration, as well as the underlying network infrastructure. With respect to the impact on market liquidity, the report concludes that “*...liquidity in the day-ahead market is more influenced by the market structure, market design (e.g. obligatory participation on power exchanges) and market concentration, rather than by the configuration of bidding zones*”. With respect to the impact on forward market liquidity, the report concludes that the bidding zone configuration may indeed have an impact on forward market liquidity and “*...from this perspective it is essential that any bidding zone reconfiguration is complemented with a forward market design providing market participants in all bidding zones with sufficiently good possibilities to hedge their price risks at competitive costs. Such design might include implementing a multi-zone hub design or Transmission Rights also between non-neighbouring bidding zones. This in turn may decrease the negative impacts, which the bidding zone reconfiguration could have on the forward market*”.
- (124) In this context, the Agency invites E-Control and BNetzA, as well as other NRAs in the CEE region, to analyse the potential negative impacts arising from the introduction of a coordinated capacity allocation procedure on the DE-AT border and, if necessary, to propose mitigating measures that address the negative impacts on market participants, at least during the transition phase. The Agency also invites the involved NRAs to analyse

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<sup>42</sup> See:

[http://www.acer.europa.eu/Official\\_documents/Acts\\_of\\_the\\_Agency/Publication/ACER%20Market%20Report%20on%20Bidding%20Zones%202014.pdf](http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Report%20on%20Bidding%20Zones%202014.pdf)

whether specific changes in the market design would be required to preserve and enhance the level of market liquidity and competition in the CEE region.

- (125) E-Control also argued that capacity allocation measures might hinder the principle of free movement of goods as they could constitute measures having an equivalent effect to a quantitative restriction on imports or exports under Articles 34 and 35 TFEU if not properly justified. Further, it stated that reconfiguration of the Austrian-German bidding zone by way of a market splitting might constitute an infringement of Articles 101 and 102 TFEU.
- (126) In this respect, the Agency notes that Regulation (EC) No 714/2009 requires a coordinated common capacity allocation for interconnections in case of structural congestions and significant impact of commercial exchanges between two countries on physical flow conditions in a third country. The Agency has to apply this requirement to a case, like the present one, where there is structural congestion and significant impact of commercial exchanges between two countries on physical flow conditions in a third country. Moreover, E-Control did not substantiate why capacity allocation on the DE-AT border would actually be inconsistent with Articles 34, 35, 101 and 102 TFEU.

HAS ADOPTED THIS OPINION:

1. There is currently structural congestion on the DE-PL, DE-CZ and CZ-AT interconnectors, as well on network elements within Germany. The cross-border exchanges between Germany and Austria are physically realised partly through those structurally congested interconnectors and through those structurally congested internal network elements. As such, they account frequently for significant limitations of the available cross-border capacity and international trade on those interconnectors, as well as for remedial actions on interconnectors and internal network elements due to congestions. In the Agency's view, the cross-border exchanges on the DE-AT border have a significant impact on those structural congestions and, in view of the structural lack of capacity, the DE-AT interconnection needs to be considered as usually unable to accommodate all physical flows resulting from international trade requested by market participants, i.e. as usually and structurally congested pursuant to Article 2(2)(c) of Regulation (EC) No 714/2009 and points 1.2 and 1.4 of Annex I to Regulation (EC) No 714/2009.
2. The existing mitigating measures, in particular the virtual phase shifter agreement on the DE-PL border and the currently investigated mitigating measures, in particular the flow-based method with Security Oriented Option, aim at fixing some limitations on the volume of North-South exchanges within the DE-AT bidding zone in order to reduce the impact of these exchanges on congestions in other parts of the CEE region. However, in the Agency's view, these measures, regardless of possible further improvements, cannot replace transparent, non-discriminatory and market-based congestion management procedures

compliant with Regulation (EC) No 714/2009, which give efficient economic signals to market participants and the transmission system operators involved.

3. Therefore, the Agency is of the view that the implementation of a capacity allocation procedure on the DE-AT border is required pursuant to Article 16(1) of Regulation (EC) No 714/2009 and points 1.2, 1.4 and 3.1 of Annex I to this Regulation. This implementation shall be coordinated at least at the level of the CEE region. Thus, the DE-AT border should form a constituent part of the CEE region for the application of coordinated capacity calculation, optimisation of allocation and secure operation of the network, as required by point 3.5 of Annex I to Regulation (EC) No 714/2009.
4. The decisions of the NRAs of Slovenia, No 141-4/2013-09/203 of 23 October 2013, of Austria, No V AUK 02/13 of 11 October 2013, of Hungary, No 2538/2014 of 12 August 2014 and No 2890/2014 of 4 November 2014, and of Slovakia, No 0027/2014/E-PP of 22 August 2014, do not comply with Article 16(1) of Regulation (EC) No 714/2009 and points 1.2, 1.4 and 3.1 of Annex I to this Regulation, to the extent that those decisions approve the rules for the allocation of cross-border transmission capacity in the CEE region, although these rules do not provide for an allocation of cross-border capacity on the border between Germany and Austria.
5. The Agency invites:
  - (a) The TSOs and NRAs of the CEE region:
    - (i) To commit, within 4 months of the date in which this Opinion is adopted and published, to the adoption of a coordinated capacity allocation procedure on the DE-AT border, with a realistic but ambitious implementation calendar with concrete steps. This implementation calendar should give TSOs and market participants a reasonable amount of time to prepare themselves for this important change.
    - (ii) To allocate maximum resources and efforts to the implementation of Flow-Based Market Coupling in the CEE region as early as possible and work together constructively to avoid any further delays or disputes.
    - (iii) To evaluate, within 4 months of the date in which this Opinion is adopted and published, whether the already implemented interim measures (e.g. the virtual phase shifter in place since February 2014) are sufficient to ensure network security, or whether additional interim measures coordinated at regional level would be necessary to ensure that the network is operated safely until a coordinated capacity allocation procedure on the DE-AT border is implemented.

- (b) The German and Austrian TSOs and NRAs to evaluate the need for potential transitory regulatory measures for market participants to accompany the implementation of a coordinated capacity allocation procedure on the DE-AT border.
- (c) All relevant NRAs to continue supporting the market integration process during the transitional period until a coordinated allocation procedure on the DE-AT border is implemented. This support may imply approving CEE congestion management rules which are not fully compliant with the Regulation (EC) 714/2009 and its Annex until the measure recommended above becomes effective.
6. This Opinion is without prejudice to the determination of capacity calculation regions, pursuant to Article 15 of the CACM Guideline, and to the final outcome of the bidding zone review process, pursuant to Article 32 of the same Guideline.

Done at Ljubljana on 23 September 2015.

For the Agency:

  
Alberto Pototschnig  
Director

## Annex I: Methodology and data on PTDF values

For the calculation of PTDF, the choice of a CGM and GSK is needed. The CGM usually represents a specific network situation characterised by the network topology, as well as generation and consumption patterns. Most often, forecasted or observed network situations are used for the creation of a CGM. The GSK means a method of translating a net position change of a given bidding zone into estimated specific injection increases or decreases in the CGM. Most commonly a proportional GSK is applied, where a change of 100 MW in the net position of a bidding zone is proportionally distributed among all injections in the common grid model.

The Agency has requested URE, ERO and BNetzA to provide the data on PTDFs for cross-border exchanges between Germany and Austria and for the structurally congested network elements as specified in Table 2 for congested areas No. 10, 11, 12, 16, 19 and 20. For these congested areas, where the network elements were not explicitly specified, the Agency asked the relevant NRAs to define them themselves. The request for data was accompanied by explicit directions with regard to the choice of CGM and GSK. With respect to the choice of CGM, the Agency selected eight common grid models where:

- a) Four common grid models represent reference grid model (RGM) scenarios determined by ENTSO-E;
- b) Four network models were selected among the latest available Intraday Congestion Forecast (IDCF) models, which TSOs are using within the process for forecasting the network congestions in the TSC region. These network models represent scenarios with different values of wind in-feed in Germany and commercial exchanges on the German-Austrian border.

The selected common grid models are presented in the first column of Tables 7 to 10. With respect to the choice of GSK, the Agency asked that the PTDF values are calculated with the upward shift of generation units in Germany (conventional and renewable-based) and downward shift of generation units in Austria. The generation units are shifted proportionally to their generation specified in the grid model (taking into account the generation both in generation nodes as well as in demand nodes) and ignoring non-linear phenomena such as the maximum/minimum power.

The cumulative data for PTDF values were calculated by the TSOs and delivered to the Agency by the NRAs. The data provided by each TSO are presented in Table 7 to Table 10. Cumulative PTDF values are presented for the network elements for the following congested areas:

- a) Area 10: DE Internal: Mecklar – Vieselbach and Helmstedt – Wolmirstedt;
- b) Area 11: DE>PL border: Krajnik – Vierraden and Hagenwerder-Mikułowa;
- c) Area 12: DE>CZ border: Rohrsdorf – Hradec;
- d) Area 16: DE Internal: Remptendorf – Redwitz;
- e) Area 19: DE>CZ border: Etzenricht – Hradec and Etzenricht – Prestice;
- f) Area 20: CZ>AT border: Sokolnice – Bisamberg and Slavetice – Durnrohr.

The PTDF values are specified in percentage terms and thus represent the percentage of cross-border exchanges on the DE-AT border realised physically through some given network elements. At the bottom of the table, the average and maximum PTDF value taken from the sample of eight CGMs are presented.

**Table 7: Cumulative PTDF values provided by 50 HzT**

Common Grid Model	Area 10	Area 11	Area 12	Area 16	Area 19	Area 20	DE>PL+CZ
RGM Summer 2013	-9.8	11.7	12.6	10.5			
RGM Winter 2014	-12.2	13.5	13.7	7.2			
RGM Summer 2014	-12.4	12.4	13.3	9.8			
RGM Winter 2015	-12.9	12.7	13.0	11.7			
IDCF 20.10.2014 11h	-15.5	13.5	15.3	7.2			
IDCF 04.11.2014 09h	-16.3	15.1	19.8	7.2			
IDCF 10.12.2014 09h	-17.7	14.3	19.3	3.8			
IDCF 24.12.2014 11h	-14.3	15.9	20.3	4.8			
Average	-13.9	13.6	15.9	7.8			
Maximum	-17.7	15.9	20.3	11.7			

Source: 50HzT (2015).

**Table 8: Cumulative PTDF values provided by ČEPS**

Common Grid Model	Area 10	Area 11	Area 12	Area 16	Area 19	Area 20	DE>PL+CZ
RGM Summer 2013			12.0		4.0	17.0	
RGM Winter 2014			12.8		5.4	20.0	
RGM Summer 2014			13.8		5.1	19.9	
RGM Winter 2015			11.6		3.4	18.5	
IDCF 20.10.2014 11h			18.4		11.5	32.4	
IDCF 04.11.2014 09h			22.4		11.2	36.9	
IDCF 10.12.2014 09h			22.3		7.9	31.5	
IDCF 24.12.2014 11h			7.8		-2.6	5.8	
Average			15.1		5.7	22.8	
Maximum			22.4		11.5	36.9	

Source: ČEPS (2015).

**Table 9: Cumulative PTDF values provided by PSE**

Common Grid Model	Area 10	Area 11	Area 12	Area 16	Area 19	Area 20	DE>PL+CZ
RGM Summer 2013	-10.1	11.8	12.6	11.5	4.0		28.4
RGM Winter 2014	-10.2	13.3	13.2	9.8	5.3		31.8
RGM Summer 2014	-12.2	12.3	12.0	9.7	4.2		28.5
RGM Winter 2015	-13.4	11.7	12.8	11.4	4.6		29.1
IDCF 20.10.2014 11h	-17.6	15.2	17.4	5.8	10.9		43.5
IDCF 04.11.2014 09h	-18.2	16.4	22.4	6.7	10.9		49.7
IDCF 10.12.2014 09h	-20.4	15.5	21.6	3.6	8.5		45.6
IDCF 24.12.2014 11h	-2.1	5.1	8.2	10.7	3.0		16.3
Average	-13.0	12.7	15.0	8.7	6.4		34.1
Maximum	-20.4	16.4	22.4	11.5	10.9		49.7

Source: PSE (2015).

**Table 10: Cumulative PTDF values provided by TenneT Germany**

Common Grid Model	Area 10	Area 11	Area 12	Area 16	Area 19	Area 20	DE>PL+CZ
RGM Summer 2013	-10.2	11.9	12.6	10.6	4.0		28.6
RGM Winter 2014	-13.2	14.1	14.2	7.5	6.5		34.8
RGM Summer 2014	-11.8	12.1	13.2	9.9	4.5		29.7
RGM Winter 2015	-12.0	11.8	12.6	11.9	3.8		28.2
IDCF 20.10.2014 11h	-13.6	12.2	14.3	7.6	7.4		33.9
IDCF 04.11.2014 09h	-15.6	14.5	19.7	7.6	8.7		43.0
IDCF 10.12.2014 09h	-16.3	13.2	19.3	4.7	6.0		38.4
IDCF 24.12.2014 11h	-13.0	14.6	19.3	4.6	6.9		40.8
Average	-13.2	13.1	15.6	8.1	6.0		34.7
Maximum	-16.3	14.6	19.7	11.9	8.7		43.0

Source: Tennet Germany (2015).

The Agency notes that German TSOs, 50HzT and TenneT Germany, as well as PSE used the GSK in such a way that only the generation in generation nodes was shifted, whereas the negative demand in demand nodes, which represent net injection into the network, was not shifted.

The analysis based on PTDF has the following limitations. While the calculation of the PTDF data is considered as accurate since it uses an AC load-flow calculation, the possible sources of inaccuracy are:

1. The assumptions used for the construction of CGM. While CGM can be considered as reasonably accurate representation of the electricity system at the transmission level (network topology, generation and load), inaccuracies may arise due to the fact that nodal injections in CGM represent the net sum of generation and load in a specific node. Thus, the values of these injections may not represent the actual load and generation in a specific node.
2. The assumptions used for GSK. Most often a proportional GSK is used, which considers all nodal injections and increases them proportionally to their value given in CGM. Because nodal injections do not necessarily represent the actual load and generation in a node, the proportional GSK may distribute the injection increase in a non-intuitive way.
3. The linear approximation. The PTDF is calculated assuming an exchange between two zones equal to 100 MW and assumes that the same PTDF would apply in case the exchange would be larger, e.g. 1000 MW. However, because of the non-linearity of electricity systems, the actual PTDF for a 1000 MW exchange may be different to some degree.