

# coreso

## Operational review 2015



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# Coreso Operational Review 2015

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# Introduction

Year after year, massive efforts to develop renewable energies and create a single energy market in Europe have deeply changed the electricity sector. More than ever, cooperation across borders is a keystone in the answer to the new challenges that TSOs are facing. In a short time, RSCIs (Regional Security and Coordination Initiative) have become central actors of this coordination and are not anymore “initiatives”: Coreso is now officially named a Regional Security Coordinator (RSC).

At Entso-e level, the multilateral agreement between TSOs (MLA) has strengthened the role of RSCs. The MLA makes participation to an RSC compulsory for every TSO and defines five mandatory services to be provided by RSCs. This has been a major step forward in defining the roles of RSCs and will have long-lasting effects in Coreso’s activities and more generally in the landscape of coordination between TSOs.

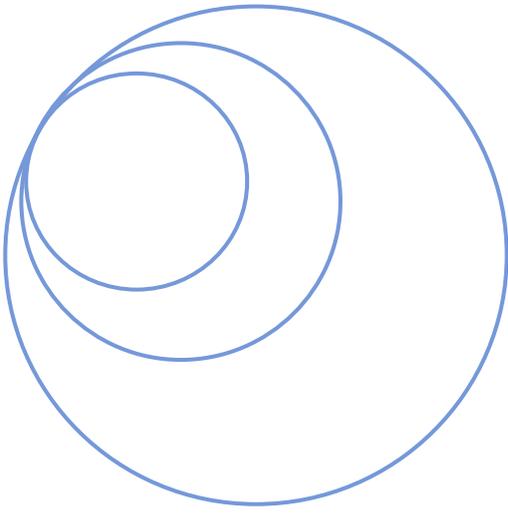
Coreso’s activities in 2015 have been largely driven by these new requirements and will be treated in the present report in the perspective of the 5 mandatory services:

- **Coordinated security analysis**  
Coreso has acquired a unique know-how in this domain through 6 years of providing this service to its shareholder TSOs. Our operators have gathered an excellent knowledge of the European grid by performing studies that cover four areas involving more than 15 TSOs. We have made decisive steps forward in 2015, such as increasing the use of IDCF files and starting a new security analysis process for National Grid.
- **Short and medium term adequacy forecasts**  
The tense situation in Belgium in the winter 2014-2015 came as a proof for the necessity of implementing of a process for SMTA (short and medium term adequacy) forecasts. Coreso took the lead on this project and set up a process that is currently in the dry run phase, with the cooperation of 22 TSOs and two other RSCs.
- **Coordinated Capacity Calculation**  
The go-live of the flow-based in the CWE area has been a huge step forward in coordinated capacity calculation. It has mobilized great resources at Coreso to ensure a successful transition and a complete adaptation of our processes on all timeframes from D-2 to intraday. The CSE area is following closely: Coreso has performed daily coordinated capacity calculations in 2015 for the external dry run phase of this project.
- **Outage Planning Coordination**  
An Entsoe-wide harmonization is being set up for the coordination of outage planning between TSOs.
- **Improved individual grid model / Common grid model delivery**  
Within the dedicated Entso-e working group, Coreso participates in the evolutions of data exchange: transition to CGMES format and setting up of the OPDE exchange platform.

Through these major axes of development, Coreso is deploying its best efforts to adapt its activities to the need of its shareholder TSOs, seeking a continuous improvement of reliability and effectiveness in the provided services.

This annual overview presents the work accomplished in 2015 in the field of the five mandatory services, provides information about additional projects and gives data about the transmission system and power exchanges in Europe.

We hope you will find useful information and wish you a good reading!



# *2015 Overview*

# 1.1 Major events at Coreso in 2015

Throughout the year, Coreso was pleased to receive numerous visits including:

- Representatives of various TSOs and RSCs: Amprion, Elia (former CEO François Cornélis and current CEO Chris Peeters), National Grid, RTE, SSC, Statnett, Svenska Kraftnät, TEIAS, TSC, the Cameroonian initiative ENEO - AES Sonel, the South African Power Pool, the West African Power Pool ;
- Representatives of other companies, organisations and institutions: various delegations from the European Commission, Entso-E and Entso-G, DuTrain, IFRI (French Institute for International Relations), the Belgian federal Minister of Energy Marie-Christine Marghem, CEER (Council of European Energy Regulators), Friends of the Supergrid, the Japanese Ministry of Energy...

Coreso wants to thank all these visitors for the dynamic and fruitful exchanges!

## January

### New Convergence Support Organization

A new organization of 24/7 support was implemented in order to ensure high availability of the “Convergence” tool. This is an important step in our efforts to continually increase our operational reliability on our critical processes, on all timeframes ranging from D-2 to close to real time.

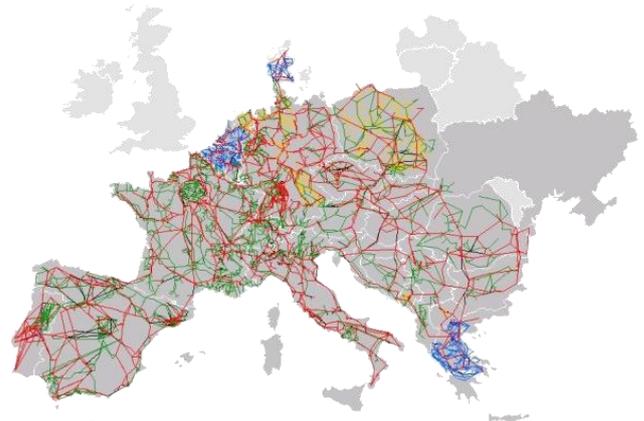
## February

### 16/02: Quality Assessment Portal

After some weeks of fruitful tests, the Quality Assessment Portal was officially launched, providing feedback on the quality of the files to all TSOs of continental Europe.

### 18/02: “Base Case Improvement” launch: improved data quality for FB

Coreso successfully started the new and improved CWE Flow-Based merging process, better known as Base Case Improvement. This process was developed with the CWE partners under Coreso convenership. It enables TSOs to deliver D2CF files with their best forecast in Load, Generation, and Net Position. As a result, this merging process increases the accuracy of the Flow Based domain, thus improving data quality and making the Flow-Based process more robust!



### 26/02: First CIM DACF hybrid merged file

Coreso started a new daily process to produce and publish a merged DACF file in CIM format containing the networks of both UCTE and GB areas, paving the way for more experience with the CIM format (ENTSO-E requirement for 2016) and for further coordination with National Grid. A security analysis is performed on the British network, establishing the first stage of the project for the integration of National Grid in Coreso’s day ahead planning process.

## March

### 20/03: Eclipse Day

A partial solar eclipse occurred in Europe in the morning of 20<sup>th</sup> March, causing considerable variations of solar infeed. In order to anticipate this event and provide additional support to its shareholders, Coreso shared special solar infeed forecasts from three days ahead up to the morning of the eclipse. A special variant of the day-ahead study was also performed, focusing on the variations of solar infeed and simulating their compensations in different parts of the grid. Finally, the situation remained under control in real time.

## May

### 19/05: CWE Flow-based market coupling successfully launched

After years of hard work and preparation, the CWE flow-based market coupling successfully went live. On 19<sup>th</sup> May, the operational process including the Flow-Based capacity calculation started for the first delivery day on 21<sup>st</sup> May. Trading with flow-based parameters for coupling began on 20<sup>th</sup> May.

The implementation of flow-based market coupling follows a memorandum of understanding (MoU) of the Pentalateral Energy Forum (PLEF) in Central Western Europe (CWE), which was signed on 6 June 2007. This MoU aims at improving the security of supply and fostering the analysis, design and implementation of flow-based market coupling between the five countries of the CWE region.

Coreso provides the merged grid models, coordinates Remedial Actions and operates the Flow-Based Common System in inter-RSC cooperation with TSCNET.

### Combined Intraday Study (CIS)

Since the go-live of the flow-based, a new CWE intraday process is operational at Coreso.

The afternoon IDCF study is now done for all the remaining timestamps of the day instead of one timestamp.

During the night, a new combined intraday report is made in 3 phases:

1. IDCF study to assess the security of the grid for the remaining timestamps of the day;
2. Study to assess bilateral ATC increase during the day;
3. Additional market corner study to anticipate grid constraints in a worst-case scenario.

With this new process, Coreso takes an important role in intraday: merging, security analysis, capacity calculation and sharing information with TSOs.

## June

### 19/06: New chairman of the board

The Board of Directors of Coreso held on 19<sup>th</sup> June has appointed Mr. Pier Francesco Zanuzzi as chairman of the Board.

### 24-25/06: Coreso operational workshop

On Wednesday and Thursday 24-25<sup>th</sup> June, RTE, ELIA, TERNA, National Grid, 50Hertz and TSC participated in the Coreso operational workshop hosted by Terna in Rome.

During these two days, post-event analysis referents of each TSO, TSC and Coreso shared their knowledge about ex-post analysis processes. It was the opportunity to exchange and to pick up good practices.

## July

### Special Study for Elia: Impact of 2 PSTs in series in Zandvliet substation

Coreso studied the benefit of using 2 PSTs in series in Zandvliet as expected for this winter.

In the studied cases, a gain of Belgian import capacity of 700-900MW is observed under certain conditions (full PST tap range available) and better balance of the import bottlenecks between Zandvliet and Van Eyck axes.

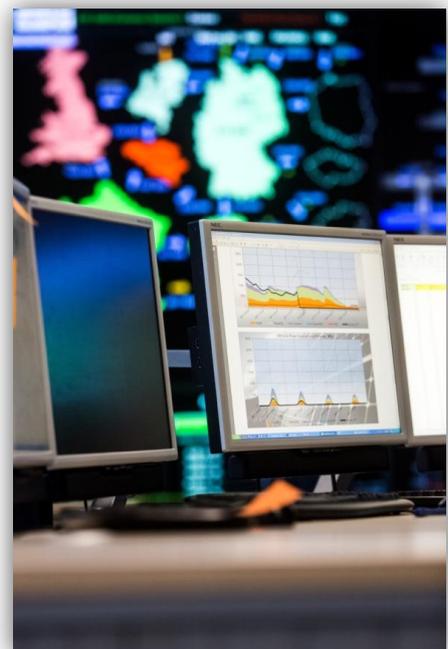
### Launch of the external dry run for CSE Capacity calculation

As Regional Security Coordination Initiatives (RSCs) Coreso and TSCnet are actively participating in the CSE Capacity Calculation project: two days-ahead, daily calculating the maximum import Net Transfer Capacities at the northern Italian border.

On 30<sup>th</sup> July, the project successfully moved into the external dry run, with daily publication of the process results on CASC web site for the first delivery day on 1<sup>st</sup> August.

The aim is to provide to market participants the opportunity to acquire sensitivity and experience about this new process.

Next step will be, after the completion of the external dry run, to enter into the full live test: with the aim of giving that new daily computed NTCs to the market players.



## September

### Impact analysis new CREOS PST

Coreso offered support for an analysis of the impact of a new PST in the CREOS grid. The goal was to help the impacted TSOs with the study of the most relevant scenarios for deeper analysis. These results were then presented to the different stakeholders of the project to prepare the implementation.

## October

### 06/10: new IT infrastructure for Convergence

After several months of planning, Coreso successfully implemented its new IT infrastructure on Tuesday, including a renewed "Publicoreso" FTP server and faster computation servers running its grid simulation software (Convergence). This major IT change now allows Coreso to perform faster analyses as well as to prepare itself for future projects' needs.

### 13-14/10: Coreso operational Workshop

Rte, ELIA, TERNA, National Grid and 50Hertz participated in the Coreso Operational Workshop hosted by 50Hertz in Berlin. During these two days, TSOs and Coreso shared their knowledge about integration and management of renewable energy from D-2 to real time from an operational point of view.

### 30/10: Go-live of the day ahead planning process with National Grid

Coreso successfully started the day ahead planning process with National Grid, establishing the first daily operational process between the two entities. It is also the first operational process using the CIM-xml format as offline planning data and the first operational process with another synchronous area (GB). At this stage, the process will be performed as a parallel run, with the multiple objectives of increasing the coordination and knowledge sharing between National Grid and Coreso, as well as preparing for future operational processes.

## November

### 17/11: Trial of the redirection of flows over interconnectors (RFIs) post market closure

On Thursday 17<sup>th</sup> (12:00 to 13:00 CET), Coreso coordinated the first RFI trial on the IFA and BritNed interconnectors. The set point schedules of both IFA and BritNed were changed by 50MW each but in opposite directions to setup a loop flow of power. In addition, 50 MW trades were simultaneously performed on all borders in the HVDC loop to ensure the commercial balance of each Party. The trial was successful for all Parties (NGET, NGIC, RTE, ELIA, Tennet B.V., BritNed and Coreso) and proved the technical and operational feasibility of the RFI concept.

### 19/11: Portugal's TSO becomes a shareholder of Coreso

REN, the TSO running Portugal's HV transmission system, becomes a shareholder of Coreso, increasing the number of member TSOs to six.

Facing a growing need for coordination on a European regional basis, more and more TSOs are joining Regional Security Coordination Initiatives (RSCs) like Coreso. The European Network of Transmission System Operators for Electricity (ENTSO-E) and the European Commission are both structurally supporting this development.

## December

### 02/12: APG joins the BCI merging for Flow-Based process

APG starts the daily sending of GSK files for the flow-based capacity calculation process. This is a new important step for APG's integration in the CWE flow-based capacity calculation region. The merging process has been adapted consequently in order to use the Austrian GSK files according to the BCI (Base Case Improvement) methodology.

### 15/12: Launch of winter dry run for SMTA experimentation

Tuesday 15 December was the launch of the winter dry run for the SMTA experimentation.

This experimentation aims at performing a check and update of the short and medium term active power adequacy diagnosis, in line with agreed ENTSO-E methodologies, for shorter timeframes than seasonal outlooks. 19 TSOs and 3 RSCs are involved in this project.

Improvements of the methodology such as a probabilistic approach and PTDF computation will be integrated in the upcoming steps of the project.

## 1.2 Coreso key figures for 2015

6

member TSOs since REN joined Coreso!



### Operational figures

365/365

days when 24 merged timestamps were successfully published in the day-ahead process

63

studies were performed additionally to the normal processes to provide special assistance in stressed situations: 49 SMART\* requests and 14 intraday studies  
*\*SMART : System Modification Advice Request*



3

operational processes were completely replaced or underwent major changes to adapt to the needs of our member TSOs

### Human resources

4

operators returned to their TSO after the end of their period at Coreso

5

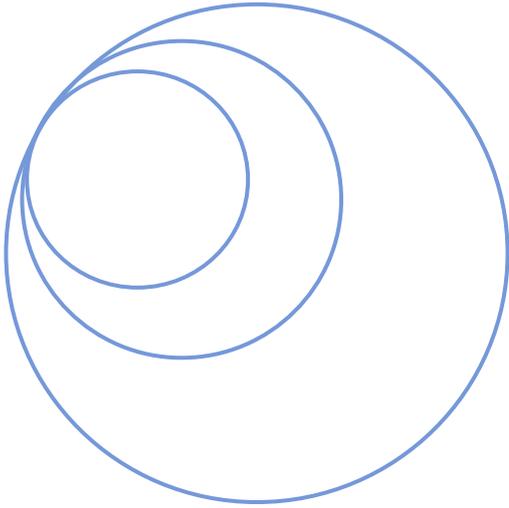
new operators were hired (1 starter and 4 colleagues from member TSOs)



3

new full time equivalent project engineer positions were created for 2016

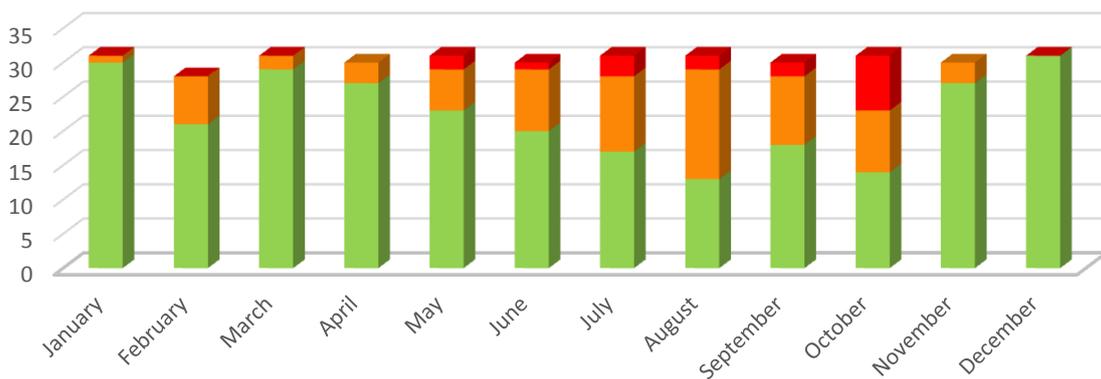
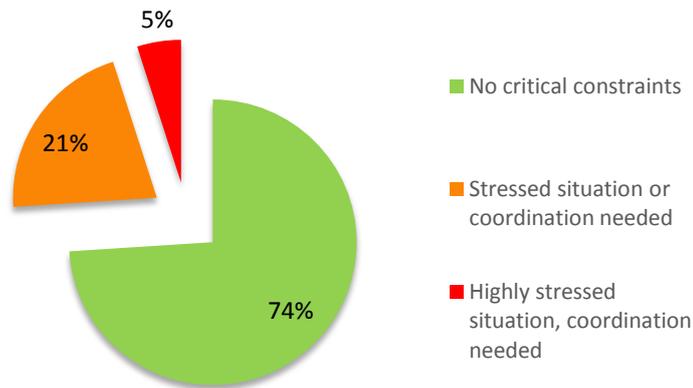
# *5 mandatory RSC services at Coreso*



## 2.1 Coordinated Security Analysis

### CWE security levels (Central Western Europe)

Day-ahead security levels in the CWE area in 2015



Occurrences	2012	2013	2014	2015
Red situations	5	6	3	18
Orange situations	57	44	51	77

As expected, with the new flow-based methodology for capacity calculation, the grid tends to be more often used up to its limits. More coordination is needed (77 orange situation in 2015 including more than 60 after FB go live) and sometimes the stress level is set at maximum (18 red situations, all after FB go live), increasing the need of support from Coreso.

During Day Ahead studies, Coreso provides calculation of critical constraints and coordinates with the impacted TSOs in order to find the most relevant set of remedial actions at a regional level.

## Example of stressed situation in the North grid in 2015 (CWE)

25/08/2015

### Context:

Critical outages:  
Zandvliet PST and Doel – Mercator (only in the morning)  
Maasbracht – Eindhoven  
Lonny-Mazures forced outage

High NL->BE exchanges  
High renewable infeed in eastern Europe:  
Up to 24 GW of wind infeed  
Up to 21 GW of solar infeed

### Day-ahead foreseen situation:

During the day-ahead process, high constraints are detected on the Belgium – Netherlands tie lines. Curative actions can be applied in both cases, requiring close coordination.

The worst constraint was on the Zandvliet PST (129%): 2 nodes in Doel or minimum tap in curative Aubange-Moulaine (115%) in off peak forcing 2 nodes in Aubange and decrease pumping in Co.

The day-ahead forecast stress level is set up to red.

### Follow-up of the situation:

During the night security assessment as well as with on the spot studies, Coreso provided support to its shareholder to find appropriate remedial actions.

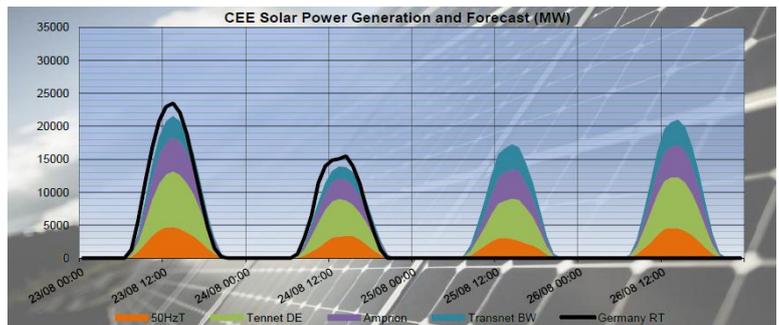
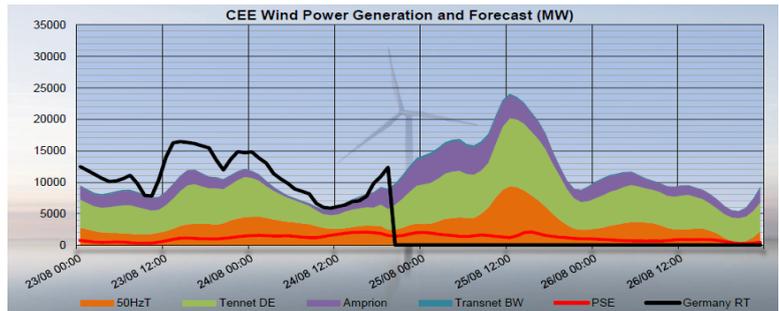
4 SMART (System Modification Advice Request) studies were launched to update the constraints and the remedial actions.

### Real Time situation:

Close coordination was needed throughout the process to assess the different remedial actions and their impact on the neighboring grids. The agreed remedial actions have been applied.

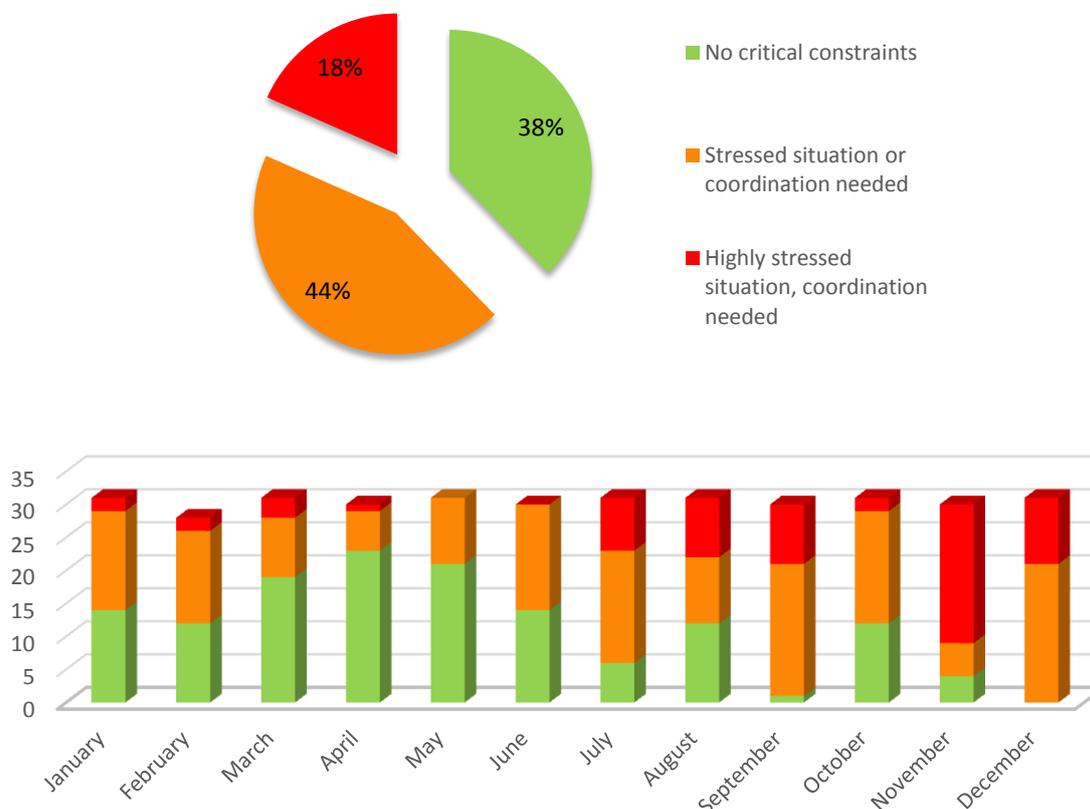
### Conclusion and perspectives:

As previously mentioned, the start of the FlowBased Market Coupling has enhanced the use of the grid to provide more capacities for cross-border exchanges leading to more situations where coordination is needed. This example shows that the usual “internal” management of real-time constraint is not sufficient anymore and Coreso, as a RSC, is there to provide its partners with coordinated studies and advices throughout the different timeframes.



## 2.1.2 CEE security levels (Central Eastern Europe)

### Day-ahead security levels in the CEE area in 2015



The follow up of the stress level started in 2014 for the CEE area. The stress level for the CEE area is defined during the day-ahead process with our colleagues of 50 Hertz based on the constraints detected and the amount of redispatching and countertrading foreseen.

Occurrences	2014	2015
<b>Red situations</b>	1	67
<b>Orange situations</b>	105	160

The increase of Renewable infeed in Germany is one of the key factor to explain the high amount of stressed situations encountered in the CEE area. Coreso aims at developing new services for 50 Hertz in the coming years to help handling this evolving network situation. Coreso will also support 50 Hertz with its PST know-how in the implementation of PSTs that are foreseen for the coming years.

# Example of stressed situations on the East grid in 2015

08/07/2015

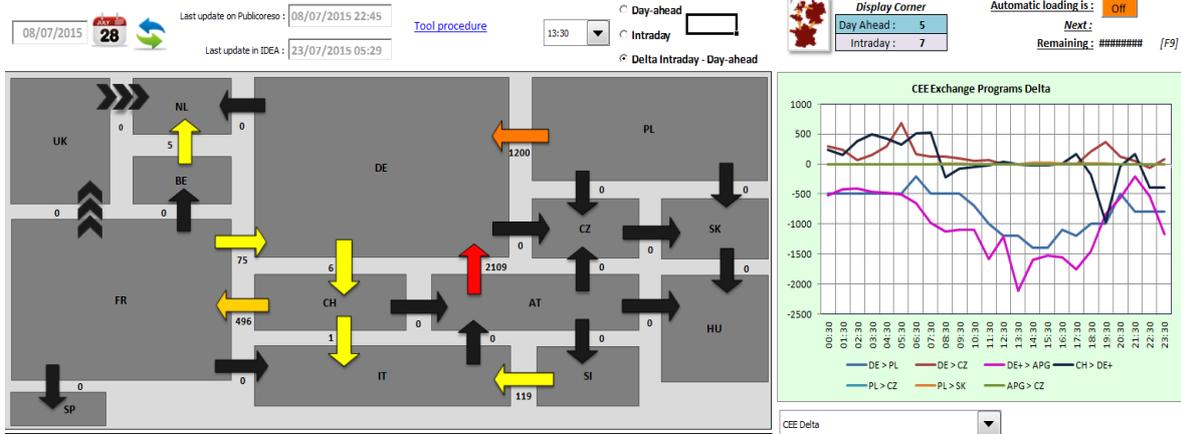
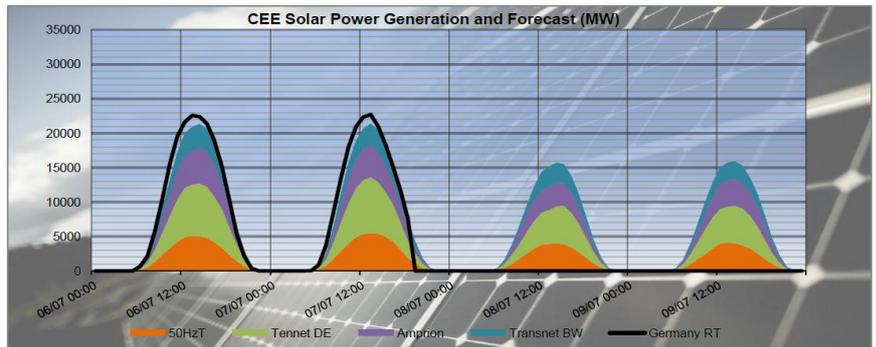
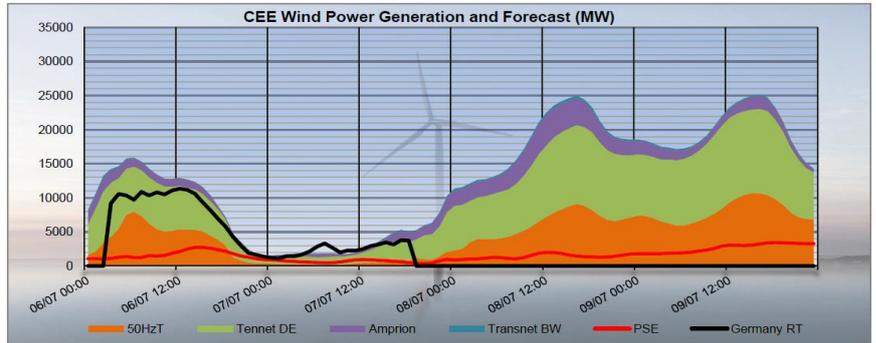
Germany is expecting a high renewable infeed of around 40 GW for the 8<sup>th</sup> and 9<sup>th</sup> July.

This leads to high export of Germany and especially from Germany to Austria.

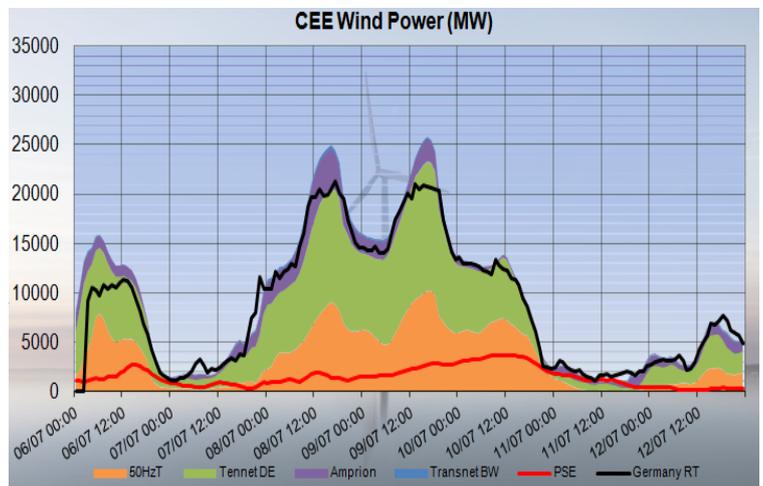
Lots of constraints are also detected on all German borders, requiring high amounts of redispatching.

Redispatching was used also on intraday market to solve the constraints as shown on the table hereunder.

CEE Renewable Power Generation & Forecast

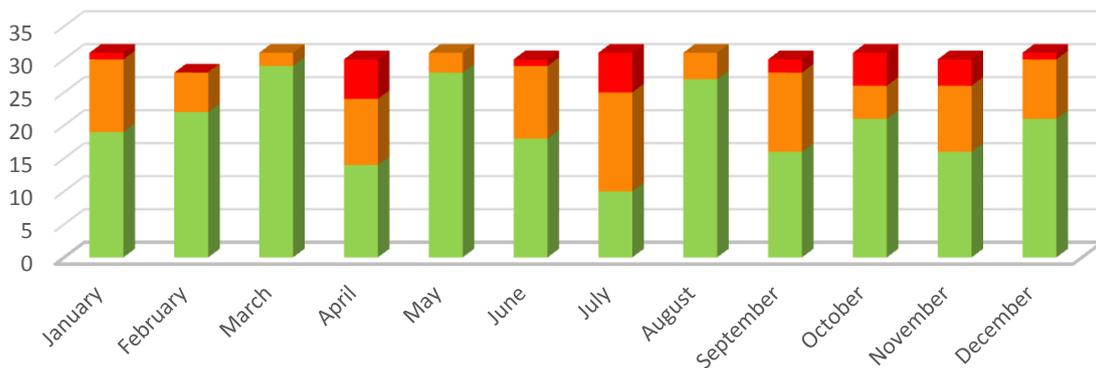
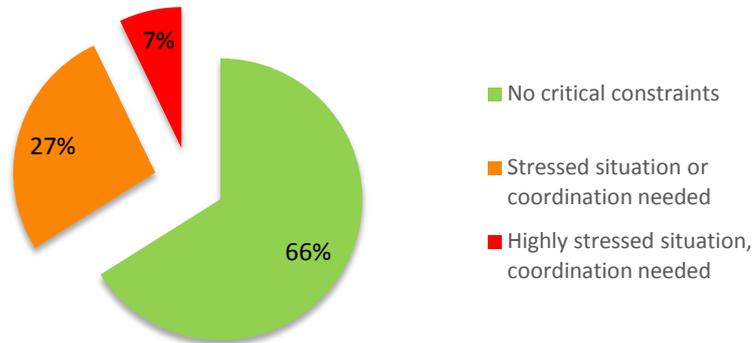


Looking at the real time wind power infeed in CEE area, it can be noticed that some curtailment was operated in order to secure the grid state.



## 2.1.3 South Stress level (Central Southern Europe)

### Day-ahead security levels in the CSE area in 2015



Occurrences	2012	2013	2014	2015
Red situations	14	11	12	26
Orange situations	69	64	66	98

The CSE area has always been a stressed area where coordination was often requested. This is due to the specific context of the area, with 5 TSOs involved, 2 RSCs and high volumes of exchanges. But we see that this trend is confirmed this year again with a higher number of both Red and Orange situations.

Coreso day-ahead studies provides to Coreso shareholders comprehensive overview of the situation. The Coreso team finds the best remedial actions available at day ahead stage and coordinates them with the involved TSOs.

# Example of stressed situations on the South grid in 2015

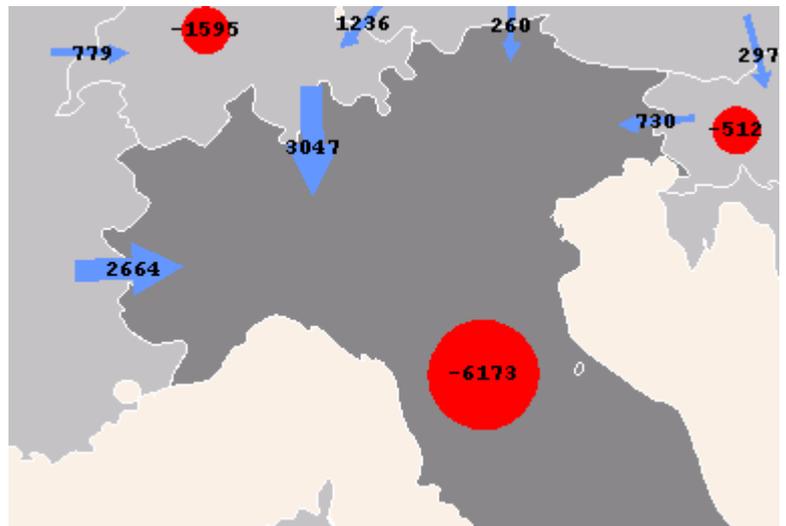
23/04/2015

**Context:**

Some outages, especially on 220kV Terna grid:  
 Chatillon Montjovet  
 Leyni Valpelline  
 Chatillon Valpelline

Total Import on the Northern Italian border:  
 6200 MW at 11:30 at Day Ahead stage.

Overview of the regional situation for DACF 11:30



**Day-ahead foreseen situation:**

Peak Study done at 09:30.

Big N-1 violations are detected during the Day Ahead security Analysis

Outage: N-2 Robbia San Fiorano / Robbia Gorlago → 110% on 380 kV line Bulciago Soazza

The study proposes a bilateral reduction (Swiss-Italy) of 600 MW => 98% on Bulciago-Soazza remaining.

**Real time situations:**

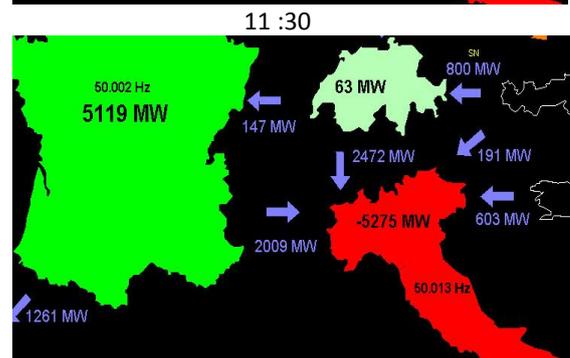
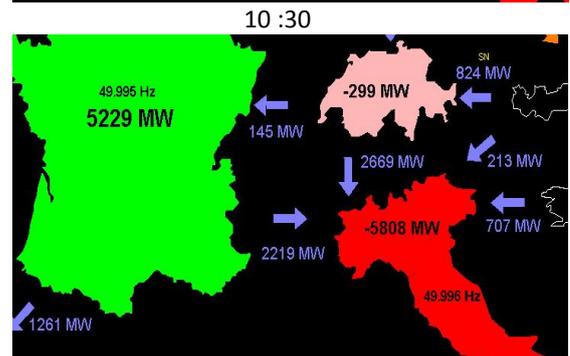
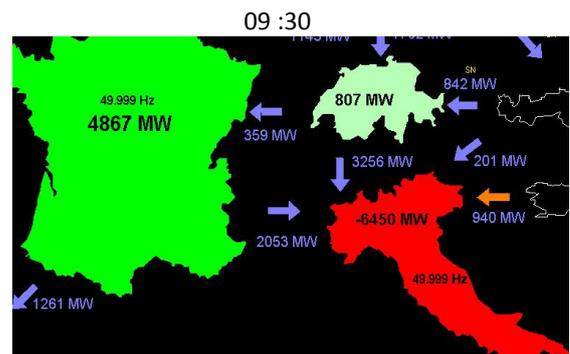
As expected during Day Ahead studies, the situation was really stressed in real time.

Bilateral reduction of 700 MW was applied on periods 10:00 – 11:00 and 14:00 – 18:00

As shown on the pictures on the right, this bilateral reduction is very effective.

**Conclusion and perspectives:**

This event shows the added value of Coreso’s day ahead studies for the CSE area.  
 It also demonstrates the purpose of looking for an improved way of computing exchange values in the CSE area. This is the goal of the D-2 CSE calculation process that has been experimented in Coreso for more than one year and that will be launched in 2016.



## 2.2. Coordinated Capacity Calculation

### 2.3.1. CWE region

#### **D-2: Go-live of the flow-based capacity calculation on 19/05/2015 for Business Day 21/05/2015.**

The implementation of Flow-Based Market Coupling follows a Memorandum of Understanding (MoU) of the Pentilateral Energy Forum (PLEF) in Central West Europe (CWE), which was signed on 6 June 2007.

The MoU aims at improving security of supply and foster the analysis, design and implementation of the Flow-Based Market Coupling between the five countries of the CWE region.



After years of hard work and preparation, the CWE Flow-Based Market Coupling went live successfully. On 19th May the operational process including the Flow-Based capacity calculation started for the first delivery day on 21st May. First trading day using Flow-Based parameters for coupling was 20th May.

Coreso remains a key element in the CWE Flow-Based capacity calculation process as it is responsible for:

- Providing the merged grid models (D2CF) on a daily basis to the Flow-Based Common System (central system performing the Flow-Based domain calculation);
- Coordinating Remedial Actions in order to increase the market domain;
- Operating the Flow-Based Common System as Flow-Based Common System Operator (FBCSO).

# 100%

Flow-based merged datasets were provided to Common System 100% of the time, meaning the 225 business days of 2015 after Go Live

# 79%

In 79% of the cases, the merged grid models were provided before the target time (20:00 D-2) to the FlowBased Common System. Reasons for delays include the quality of the input files, internal issues during the merging or late delivery of mandatory input data by the TSOs

## Intraday: CIS process (combined intraday study)

A new CWE intraday process was operationally launched at Coreso starting on the flow-based go-live business date.

Following improvements and changes were foreseen compared to our previous intraday CWE process:

- A security analysis is performed on IDCF files during the afternoon and the night for all remaining timestamps of the day (compared to one timestamp previously)
- A new combined intraday study during the night adds on top:
  - o A study to validate in name of Elia requests to increase intraday capacity (CWE IDCC process): up to 100 MW on NL-DE border and 200 MW on NL-BE border.
  - o An additional corner study to anticipate security threats when the market goes into a certain direction. This part of the study was added after considering feedback given by our shareholder TSOs.

# 224/225

Coreso provided results for intraday Capacity assessment for 224 of the 225 business days performed in 2015.

Note: the day where Coreso did not provide the results – due to IT issues, Coreso advised to refuse the capacity increase.

### 2.3.2. CSE region

Coreso is a key player in the development and implementation of the new **D-2 capacity calculation on Italy's Northern border**. The five involved TSOs (APG, Eles, Rte, Swissgrid and Terna) have been working since 2012 with their RSCs Coreso and TSCNET on this project which aims at performing a coordinated daily D-2 NTC computation process on Italy's northern border, basing its calculations on the latest available information from the interconnected system, to provide optimised cross-border capacities for the day-ahead market.

This coordinated capacity calculation is based on D2CF files provided by the TSOs and uses an algorithm that optimizes remedial actions in order to find the highest secure level of import on the Northern Italian border. Expected benefits of the D-2 calculation process are a higher level of network security and optimized cross-border capacities compared to the current yearly calculation process.

An internal dry run of this project was started in February 2014, meaning that the calculation was made daily on two timestamps (03:30 and 10:30) without using the results for capacity allocation. In this phase, the results are analysed internally to improve the process. On 30 July 2015, the external dry run of the project started: from this point, the computed NTCs were published to inform all stakeholders, but still without using them for allocation.

During these phases, Coreso collaborated closely with the five involved TSOs and TSCNET in order to improve the process step by step and to prepare it for the following phases programmed for 2016: the full live test and the go live.

## 2.3. Short and Medium Term Adequacy Forecasts

An Entso-e working group has been launched to develop a process for short and medium term adequacy (SMTA) forecasts. Coreso is leading this working group in close cooperation with the RSCs TSCNet and SCC, and with the TSOs.

The SMTA service aims at performing a regional check/update of short/medium term active power adequacy diagnosis, in line with agreed ENTSOE methodologies, for shorter timeframes than seasonal outlooks. This adequacy review shall be made comparing local adequacy inputs and grid capacity to carry cross-border exchanges. This diagnosis can include recommendations such as remedial actions to optimize cross-border exchanges, request to Balancing Service Providers in the Coordinated Balancing Area (CoBA) to change their availability status.

When needed (at least regional scarcity issue, cross-zonal capacities insufficient), a dedicated complementary security analysis can be performed and coordination can be extended to other regions/RSCs. The resulting recommendations may consist in cross-zonal capacities adaptations/combinations in addition to the previously mentioned recommendations.

The winter dry run of the SMTA experimentation was launched on 15 December and has been carried out on a weekly basis since then.

### First steps of the SMTA experimentation project

The first steps preparing this dry run are the results of an intensive and fruitful collaboration between Coreso, TSCNET and ENTSO-E:

The initial concept of the project has been based on the expertise of ENTSO-E regarding the Seasonal Outlook studies.

Data definition and set up are handled in cooperation with ENTSO-E.

The representatives of Coreso and TSCNET TSOs participating in the sub-group specified the concept to be developed for this dry run.

This concept, currently limited to a simple deterministic and NTC approach, has been validated by the ENTSO-E SMTA PG on 20th of October.

Coreso developed the IT prototype for the dry run, in close collaboration with TSCNET.

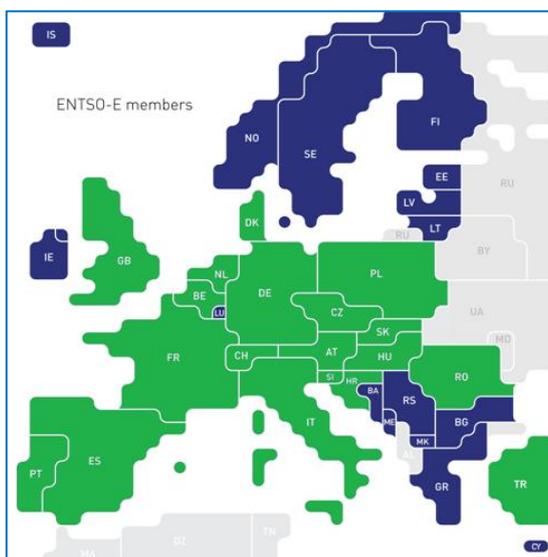
All participating TSOs sent their remaining capacity (RC) forecasts on a weekly basis since October 31st.

The Week Ahead NTCs are extracted from the ENTSO-E Transparency platform.

Starting with a sample delivery of remaining capacity by TSOs for Week 43, the first tests of the process have been performed from Week 45 to 50.

Data quality and inconsistencies are a resulting focus point for the dry run.

A weekly report has been developed to present the results of the Adequacy assessment together with input data quality validation.



### Current status

22 TSOs and 3 RSCs are involved.

### Next steps

The dry run will be processed until end of March and be concluded by a summary report in April 2016.

In the meantime, improvements of the methodology will be prepared as integrating load flow computation and a merit order approach.

## 2.4. Outage Planning Coordination

In the frame of the outage planning coordination project (OPC), ENTSO-E Network Code Operational Planning and Scheduling requires TSOs to establish a common medium- and long-term outage planning process based on predefined standards with the following key objectives: ***ENTSO-E wide harmonization of regionally differing outage planning processes.***

All TSOs of each capacity calculation region shall jointly set-up a regional security coordinator and establish rules governing its operations or appoint another regional security coordinator (RSC) to perform regional outage coordination.

TSOs already perform successful Outage Planning activities for areas defined over years of experience, however there is not yet a commonly agreed process, regarding the implementation of the RSCs in outage coordination, to be followed among all ENTSO-E TSOs. Therefore, ENTSO-E setup the “TSO coordination strategy implementation with RSCs” project with the goal to implement the future TSO coordination strategy as described in the ENTSO Policy Paper released in November 2014. The project aims at building an outage planning and coordination process based on already existing outage planning coordination within TSOs and experience from pilot phases and dry runs.

Coreso is working closely together with TSCNet, who is leading the working group for this coordination service. TSOs and RSCs are collaborating to design these common practices and will support the further drafting and adaptation of an intermediate business process for outage planning, which will be the basis for a dry run.

Currently, TSC TSOs started a dry run, consisting in the merging of the outages for weekly and monthly process, which allows a systematic check of the planned outages and ease coordination among TSOs. Coreso TSOs will join the experimentation in 2016.

Furthermore, it is planned to enrich this process with an intermediate checking of interdependent outages, which has been proposed on a voluntary basis for all TSOs within OPC.

## 2.5. Improved Individual Grid Model / Common Grid Model Delivery.

Coreso is involved at the Entso-e level in the Project Team Common Grid Model (PT CGM). This CGM project details all the different aspects of the future exchange of Individual Grid Models, the future format to exchange grid models (CGMES), the future exchange platform Operational Planning Data Environment (OPDE), and the merging Function in order to build the Common Grid Model.

Coreso is one of the future hosting entities of this future network OPDE and archive database, and Coreso is also one provider of the European Merging Function. Convenorship of design of this European Merging Function was given to Coreso.

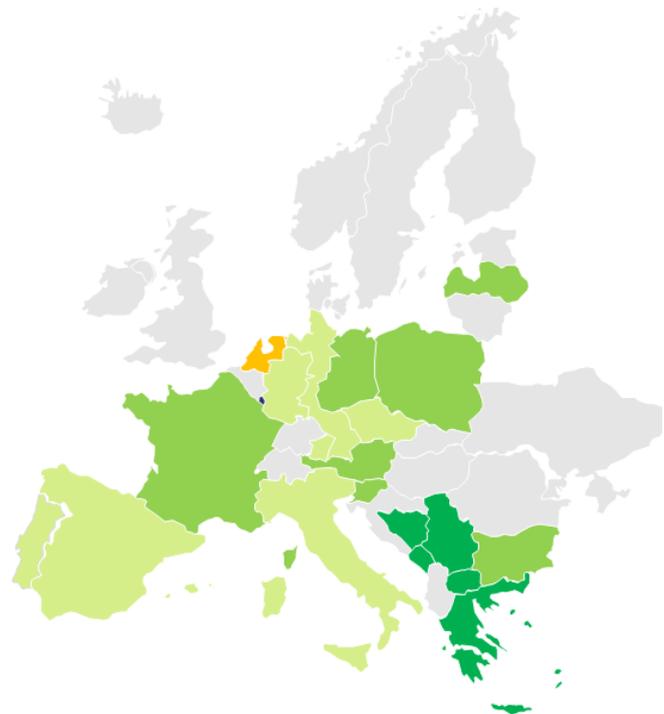
CGMES format exchange has been decided by all Entso-e TSO in 2013, in order to daily exchange IGM files within this format by end of 2016. Coreso's tools are compliant with the new exchange format CGMES, even if some additional functions and requirements will be updated in 2016. By end of year 2015, 4 out of 6 Coreso shareholders were able to deliver CGMES files, by respecting CGMES format and having a sufficient level of quality to be run in Coreso tool.

Coreso also supported test runs with all Entso-e TSOs in order to test interoperability of TSO IGMS with Coreso tool. The picture below gives the CGMES status of TSO readiness in December 2015, based on the success of interoperability test with existing Merging tools (Coreso tool and SCC tool).

### Inter-Operability between TSO domestic tools and EMF tools

01 December 2015 09h30Z

Successful import of IGM and successfully solved power flow in two EMF tool without manual corrections -> 5
Successful import of IGM and successfully solved power flow in one EMF tool (without any correction) -> 7
Successful import of IGM and successfully solved power flow in one EMF tool <u>with</u> manual corrections -> 6
Successful import, power flow could not be calculated -> 0
Import of models failed (too many issues to correct manually) -> 1



# Focus on RFI project

## Introduction

The Redirection of Flows over Interconnectors between Great Britain and the continent (RFI) is a project involving by Elia, NGET, RTE, TenneT B.V., Coreso, BritNed and NGIC. Its goal is a tool that could be used in real time operation to modify the flows on the cables between Great Britain and the continent. When available, it could be a very efficient method for recovering and maintaining AC system security when the grid is under strain. The method can also help to lower balancing costs for HVDC link owners in the event of an HVDC link failure and to reduce TSO's operating costs after gate closure. Flows redirected over interconnectors by the Parties have no impact on the power market or on market-based flows.

## Definition

Redirecting flows over interconnectors is a way of relieving network constraints, irrespective of their origin, during the operational phase in one or more of at least two neighbouring AC synchronous areas connected by at least two HVDC links. Overloads may or may not be predicted, and can have various causes, such as deviations from planned AC load flows, i.e. excess of wind power, and/or AC component failures. Changing the set-point schedule for parallel HVDC links for the same quantity of power (but in opposite directions) sets up a loop flow that relieves the congested AC area. This may offer an alternative to real-time redispatching, which may very often be extremely expensive and sometimes even be impossible to execute.

Flows may only be redirected over interconnectors if sufficient spare capacity in the relevant direction is available during the respective operational period along all the AC and DC corridors comprising the loop. RFIs may only be initiated post market closure so they are transparent and do not affect commercial positions. By definition, RFIs yield no power balance and have no frequency- or price-related consequences in the AC synchronous areas involved. The net changes in the HVDC links involved, i.e. rescheduling, always adds up to 0 when viewed from either of the two synchronous areas.

## Benefits

The Parties have looked into the benefits of implementing RFIs and reached the following conclusions:

For NGET, the key benefit is to enable small flow changes to take place that allow filter banks to be switched and so ease high voltages at night. It also regards RFIs as a useful tool for pre- and post-fault control that can be used to decrease overloads on elements in South East England.

For TenneT, the key benefit is to allow greater control of filter-bank switching, particularly to alleviate high-voltage events. But RFIs are also a useful tool for pre- and post-fault control, enhancing PST coordination between Germany, Belgium, the Netherlands and France.

For Elia, the key benefit concerns pre- and post-fault control, with RFIs enhancing PST coordination between Germany, Belgium, the Netherlands and France.

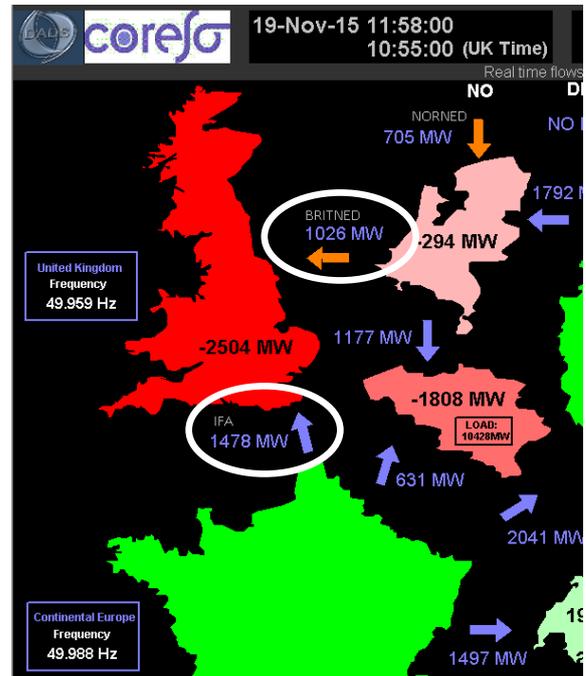
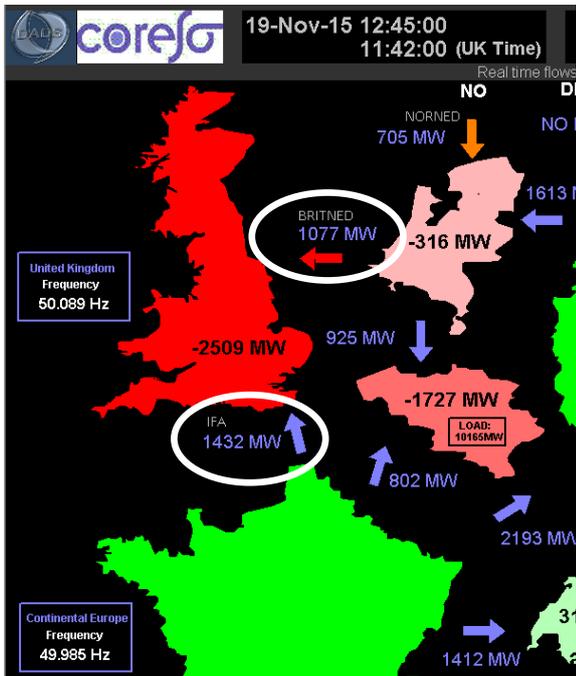
For RTE, NGIC and BritNed, the key benefit of redirecting flows over interconnectors is smaller imbalances once an interconnector has been tripped.

Any TSO can initiate RFIs (RTE, ELIA, TenneT, NGET - also on behalf of NGIC and BritNed) in either a clockwise or an anti-clockwise direction. These RFIs are then coordinated by CORESO and enacted by the Parties.

## Trial information

The purpose of the RFI trial was to test:

- The RFI concept;
- the feasibility of RFIs using BritNed and IFA;
- operating protocol;
- communications between the parties;
- commercial settlement processes.



On Thursday, 19 November (between 11 a.m. and noon GMT) Coreso coordinated the first redirection of flow (RFI) on the IFA and BritNed interconnectors after market closure. The schedules of both IFA and BritNed were simultaneously altered by 50 MW, but in opposite directions, to set up a loop power flow. At the same time, 50 MW trades were executed on all continental borders in the HVDC loop to ensure the commercial balance of each Party. BritNed's emergency rating was used during the test, since BritNed was already operating at full commercial capacity during the trial hour.

#### Conclusion from the trial

The technical results of the trial show that RFI is highly efficient on the AC networks between the HVDC links (up to 74% effective in some cases). In addition, no frequency deviation was observed as a result of flow redirection, since ramping by IFA and BritNed was accurately synchronised at the beginning and end of the trial. Operational communications between all the Parties involved went as planned, and their individual execution of the RFI took less than 10 minutes. The trial was successful for all Parties and proved the technical and operational feasibility of the RFI concept.

#### Next steps

Given the success of the trial, the TSOs involved in this project hope that an enduring service (limited in the first instance to emergency situations) can be established. Private interconnector companies need to assess the commercial viability of RFIs as a product before committing further resources. Coreso will publish theoretical conclusions and the results of experimental trials and analysis.

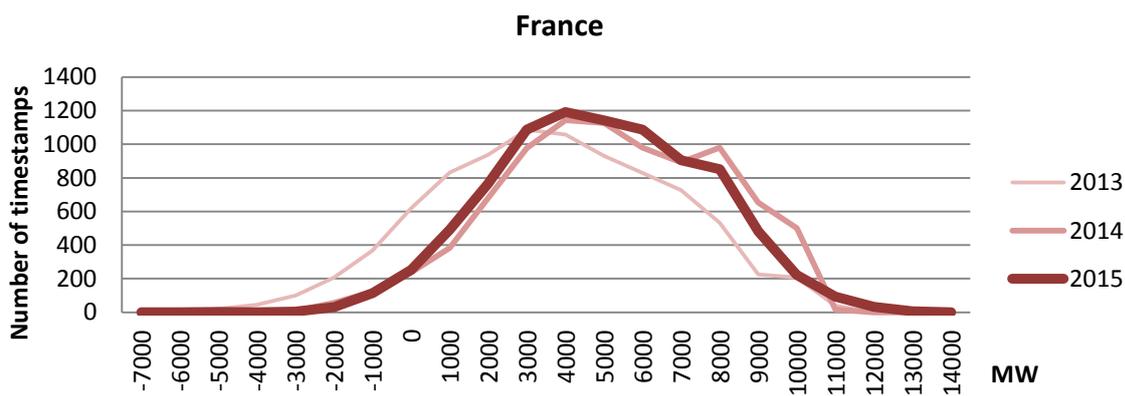
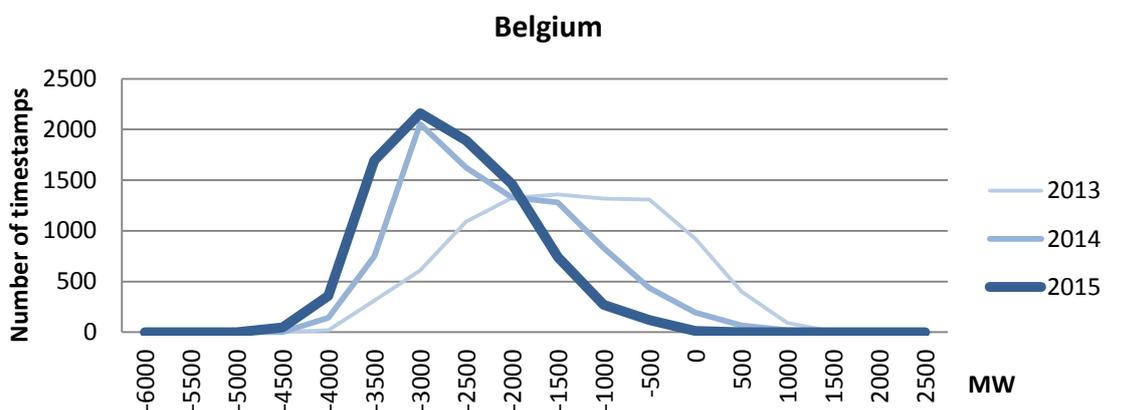
# Exchanges & renewables in 2015

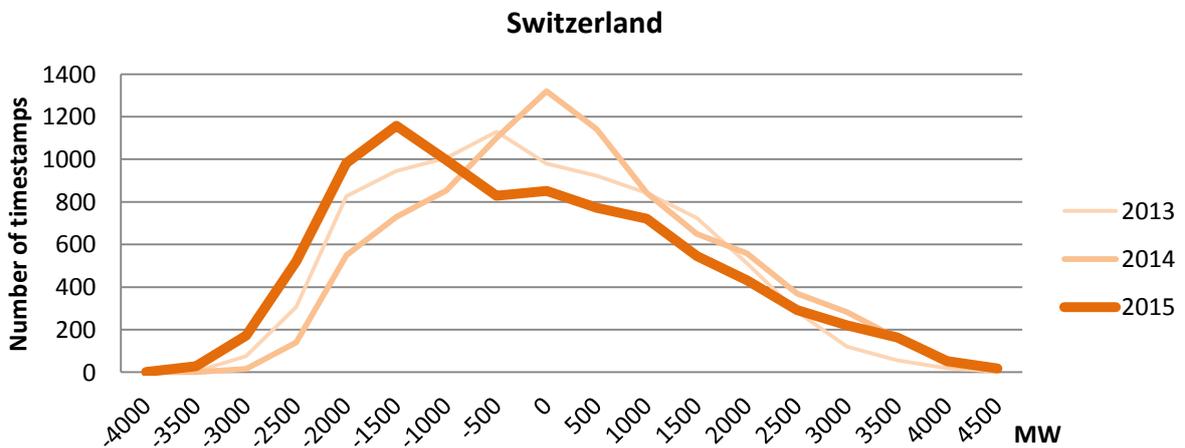
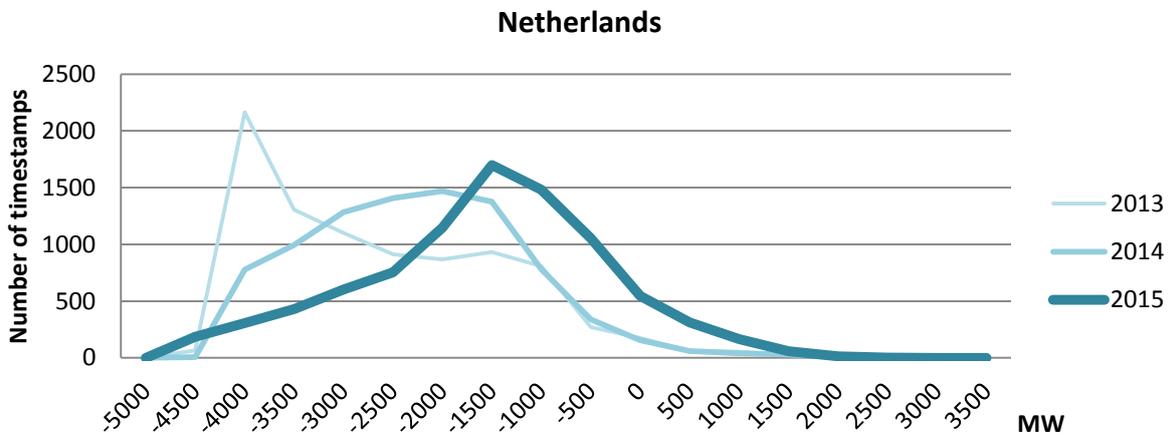
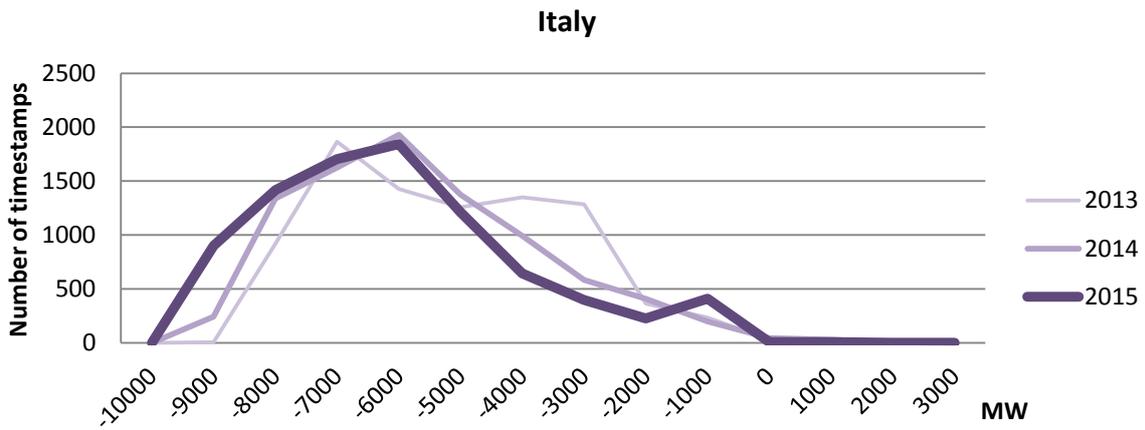
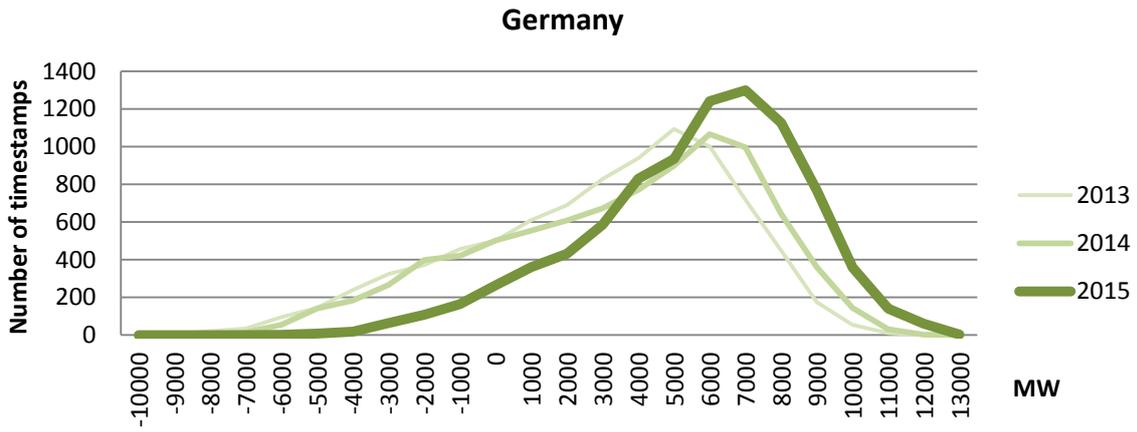
## Import/export balances per country

The following figures show the statistical distributions of the balances of six countries over the past three years. The data comes from the Vulcanus platform ("Realized control programs"), which means that they do not include the exchanges on IFA and Britned cables.

For Belgium, Germany and the Netherlands, trends can be identified over the three represented years. The Belgian balance is shifting towards higher imports and the situations of export tend to disappear. The German balance, which is structurally mostly positive, is showing a clear trend towards more and more frequent situations of very high exports above 6000 MW. This is partly due to the strong development of renewable energy in Germany. The Netherlands remain mostly an importing country but with clearly decreasing imports over the past three years.

For the other countries represented in the figures, the evolution is not as clear. However, it can be noted that for Italy and Switzerland, the situations of very high import were more frequent in 2015 than in 2013 and 2014.



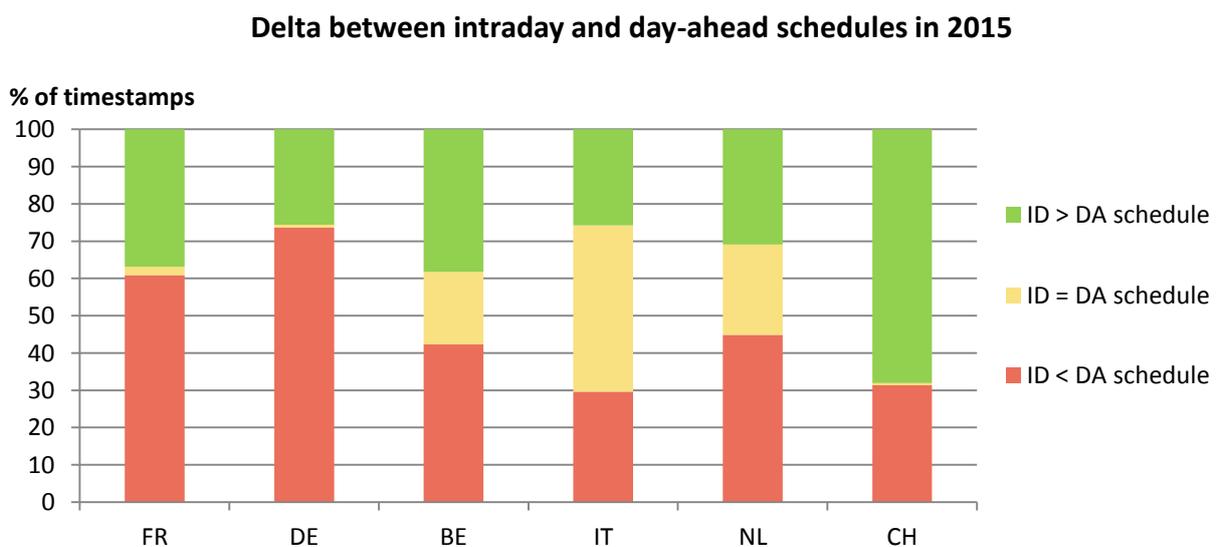
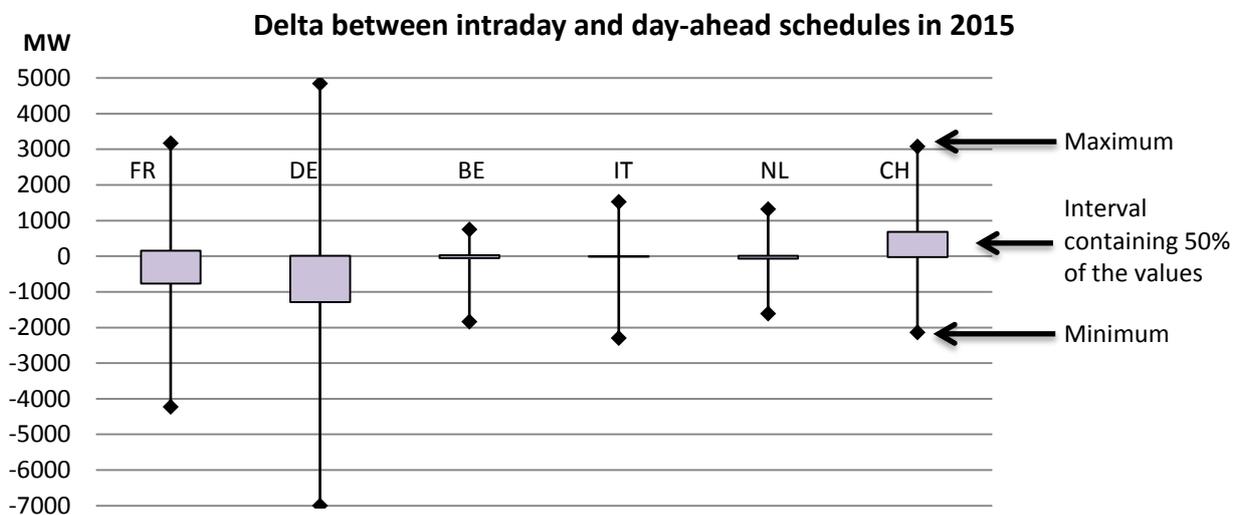


# Delta between intraday and day-ahead balances

Coreso's activities include day-ahead and intraday grid security studies. Intraday trading is one of the factors that can create differences in the results between those two timeframes.

The two figures below show some statistics about the difference between the intraday and the day-ahead schedules in 2015 for six countries. They reveal structural differences between the markets of the compared countries. In Belgium, Italy and the Netherlands, on more than 20% timestamps there is no intraday trading. In France, Germany and Switzerland, more than 97% of timestamps in 2015 were affected by intraday trading. The traded energy amounts also vary a lot, with up to 7000 MW traded in intraday for Germany.

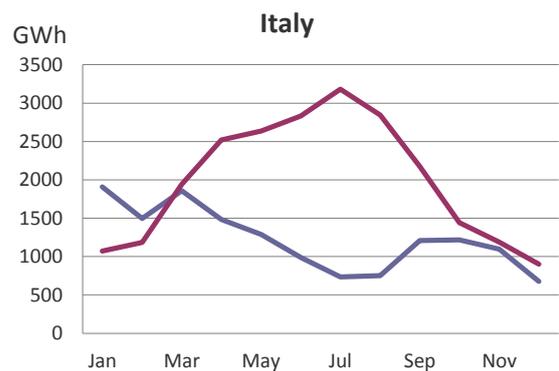
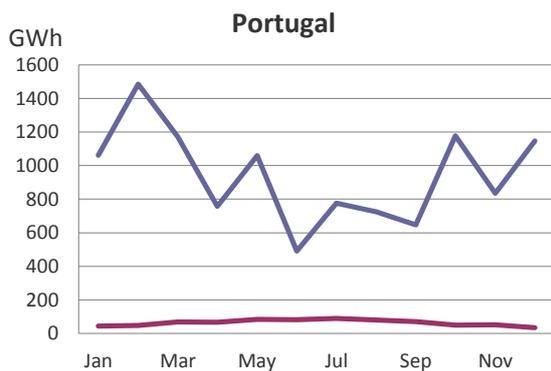
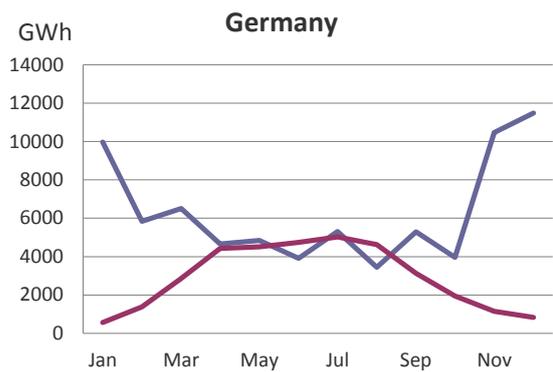
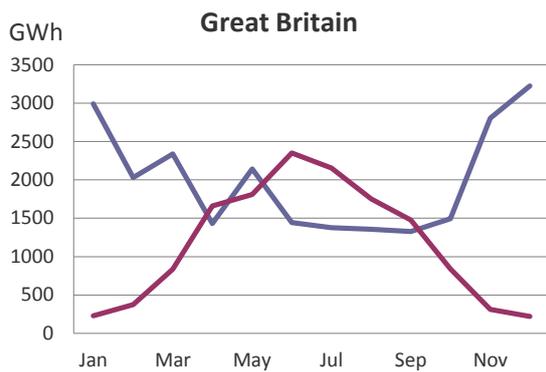
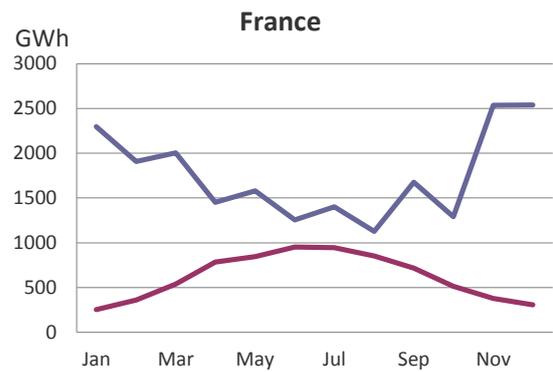
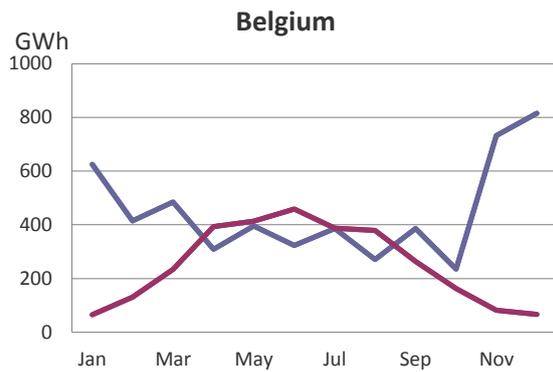
Intraday exchanges are one of the major sources of difference between day-ahead grid security studies and the real time situation. As they have a wide-scale cross-border effects on the physical flows, Coreso as an RSC is in a strategic position to evaluate their impact on intraday security studies and capacity assessments.



# Renewable Energy Overview

The figures below show the wind and solar energy generated per month in 2015 in Belgium, France, Great Britain, Germany, Portugal and Italy. Seasonal variations can be distinguished: the wind generation tends to be higher during the winter, whereas the solar energy unsurprisingly reaches its maximum in the summer.

Legend:   
— Wind   
— Solar



Source: [www.entsoe.eu](http://www.entsoe.eu)



Thank you for reading!

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