

Implementation of day-ahead (DA) market coupling in the North-Western Europe (NWE) region – summary memo

Summary	This document gives a general description of the key principles underpinning the NWE DA project and also an overview of the changes involved vis-à-vis the CWE market coupling and CWE-Nordic Interim Tight Volume Coupling mechanisms.	
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Related documents

Annex 1	Description of Partial Coupling and Full Decoupling Scenarios
Annex 2	Slides presented at the 2nd Stakeholder Forum in London on 14 June 2013 – NWE procedures and timings

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1 Introduction

The NWE DA Price Coupling project, a collaborative initiative that aims at putting a price coupling in place for the day-ahead electricity wholesale markets in the North-Western Europe (NWE) region, has been launched by the Transmission System Operators (TSOs) and Power Exchanges (PXs) of the countries in the NWE region. This day-ahead market coupling mechanism is based on the price coupling principle, whereby, thanks to the bids received from the market participants and the available border capacities, a single algorithm can calculate both the net positions on each hub and scheduled exchanges at interconnections between the various market areas.

A price coupling mechanism of this kind is crucial for implementing the European Day-Ahead Target Model – a model that strives, by means of implicit auctions, to optimise hub and cross-border transactions and at the same time determines volumes and prices in all the relevant areas. This will be facilitated by the power exchanges' joint Price Coupling of Regions (PCR) initiative which will be adopted throughout Europe at a later stage.

The NWE DA Price Coupling project includes the planning and the rolling out of the PCR solution in the NWE region, comprising the Nordic region (Denmark, Finland, Norway and Sweden), Great Britain and, the CWE region (Belgium, France, Germany, Luxembourg and The Netherlands).

The contractual agreement between the various participants in the project clearly states that the solution and mechanisms used in NWE must be transparent and easily extendable, with a general view to facilitating other regions joining the price coupling mechanism in the context of the integration of the European electricity markets. This is fully in line with the *Cross-regional roadmap for Day-Ahead Market Coupling*, which puts forward a Single European Price Coupling (EPC) mechanism and states the following: "NWE shall concentrate on what is needed to implement NWE price coupling in 2012, be transparent, flexible and open to enlargement via arrangements/structures differing from NWE".

2 Description of PCR

PCR is an initiative of seven European power exchanges (APX, Belpex, EPEX SPOT, GME, Nord Pool Spot, OMIE and OTE) that strives to develop a single price coupling mechanism that can be used to calculate electricity prices throughout Europe, and to allocate cross-border capacity on a day-ahead basis. The result shows the net positions and scheduled exchanges at interconnections between market areas.

PCR is based on three key principles: a single shared algorithm, robust operation and individual responsibility of the power exchanges.

1. The joint algorithm (Euphemia) will calculate the day-ahead electricity prices in Europe and allocate cross-border capacity in a fair and transparent way. This algorithm was developed taking into account the specific features of the various energy markets across Europe and will optimise general welfare and increase transparency.
2. The PCR process is based on decentralised distribution of data, ensuring robust and flexible operation.
3. The PCR Matcher and Broker (PMB) service enables the power exchanges to exchange anonymised orders and transmission capacity with each other in order to calculate the market prices for each area. The scheduled exchanges at the various borders are also calculated.

The PCR architecture consists of various PMBs that are connected to each other via the PMB cloud (which is only accessible for PMBs). A PMB system set up at each NWE power exchange replaces the current market coupling systems that are used locally in CWE and the Nordic region and at EMCC to calculate Interim Tight Volume Coupling (ITVC).

Each power exchange is responsible for gathering the Cross-Zonal Capacities (CZCs), allocation constraints such as ramping constraints, and bidding orders for their region via their local systems. The PCR architecture means that all these data are shared among the various PMBs, and therefore all NWE power exchanges can perform the calculations at the same time drawing on the same general data.

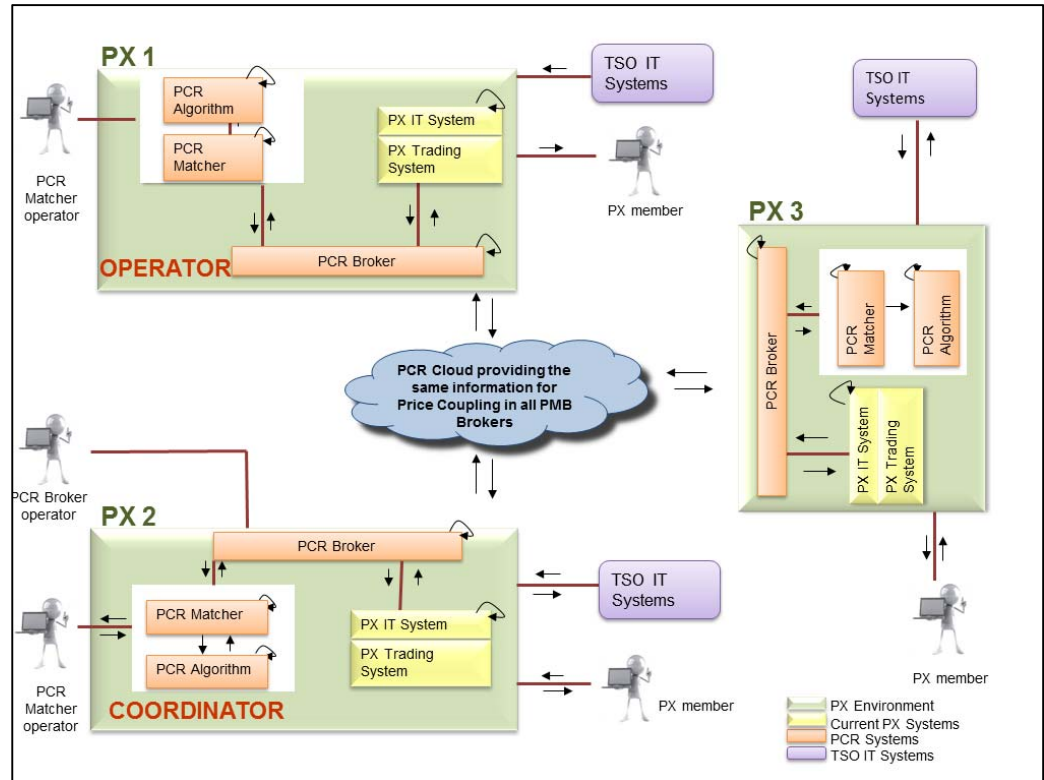


Fig. 1: PCR architecture

Each PMB system contains the PCR algorithm and links to local PX IT systems. Each NWE PMB system consists of the following modules:

- **PCR Algorithm:** The Euphemia algorithm calculates the NWE grid positions (i.e. quantity of imports/exports for each hub), the market prices and the scheduled exchanges.
N.B.: The scheduled exchanges calculated at internal CWE borders are not used; these are calculated at regional level by the CWE TSOs.
- **Broker module:** Each local broker module is responsible for the local PMB's interface with other PMBs (via the PMB cloud) and local PX IT systems (via Web services). It processes the data transmitted between the other PMB Brokers and the local power exchange:
 - all capacities (CZCs) and allocation constraints;
 - all order data, in anonymised form for each hub based on the aggregate purchase/sale curves for hourly bids, anonymised individual block orders and other complex profile bids;
 - the complete set of price coupling results;
 - the preliminary and final results of local validations;

- the preliminary and final results of the overall validations.
- **Matcher module:** this makes all the data (CZCs, allocation constraints, orders and algorithm parameters) received from the Broker module available to the algorithm and activates this algorithm. This module also receives the results of the price coupling and forwards them to the Broker module.

3 Euphemia algorithm

The algorithm used in the PCR system is called Euphemia. This price coupling algorithm was developed by the NWE power exchanges, along with OMIE (Spain and Portugal) and GME (Italy), as part of the PCR project (which OTE (Czech Republic) joined recently). The algorithm's name consists of 'EU' as a prefix followed by the acronym PHEMIA (standing for 'Pan-European Hybrid Electricity Market Integration Algorithm'). The algorithm is considered as hybrid as it supports any combination of ATC-based and flow-based network models.

Euphemia's starting point was the Cosmos system which has been in use since November 2010 for the market coupling in the CWE region, and which was recently introduced in the Czech Republic, Hungary and Slovakia in the context of the trilateral coupling between these three countries.

The general optimisation model applied in Euphemia is currently also being used in the Nordic and Baltic regions, where it was rolled out in late 2007 in the form of Nord Pool Spot's SESAM trading system, showing that the main characteristics of the algorithm have been firmly entrenched in the NWE markets for a number of years now.

All of the power exchanges have to ensure that their own trading systems, which each of them is continuing to use, is compatible with the PCR price coupling system.

4 NWE market coupling

This section describes the general functional architecture (High Level Functional Architecture (HLFA)) of the market coupling solution in the NWE region.

We define the NWE price coupling as the set of system components and arrangements put in place or adjusted with the explicit purpose for establishing the coupling of the day-ahead electricity markets that form the NWE region. The high-level NWE price coupling process can be schematically presented as follows:

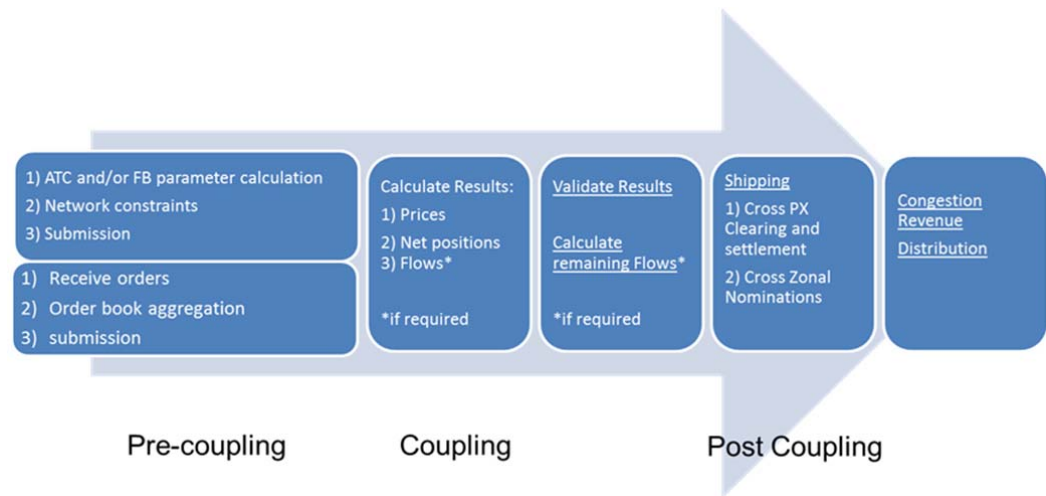


Fig. 2: NWE price coupling process

The **pre-coupling phase** can be divided into tasks for the grid operators and tasks for the power exchanges.

As for the first of these two groups, all the TSOs calculate the available commercial interconnection capacities. The details of these capacities (along with any allocation constraints) are passed on to the power exchanges, which then forward them to the PMB system. The scheduled time when these capacities will be published by the TSOs remains 10.30 a.m. (CET), as was the case for the CWE market coupling. Within the CWE region there is no change to the method for calculating the commercial interconnection capacities vis-à-vis the current coordinated calculation method.

As for the second group, the power exchanges will receive purchase and sale bids from their market participants until the Gate Closure Time (GCT) of 12 noon (CET). These bids are forwarded in anonymised, aggregate form to the PMB system.

Then in the **coupling phase**, on the basis of these input data (network and order data), the Euphemia algorithm will calculate a result for price coupling for the whole NWE region. The result comprises a price and a net position per hub per hour and also the scheduled (cross-border) exchanges. However, it should be mentioned here that the scheduled (cross-border) exchanges at the internal CWE borders are not used but are calculated just after this step by the CWE TSOs themselves.

The expectation following initial testing within PCR is that the (“preliminary”) results can be published at about 12.42 p.m. (CET) and the final results at around 12.55 p.m. (CET). *N.B.*: The process times mentioned may yet change slightly during the simulation tests.

Therefore, this calculation, which is carried out in a single step, replaces the sequential process that is currently used between the CWE and Nordic regions. Here, in an initial step the volume is determined at the interconnectors between the two regions (via the ITVC algorithm), and then in a second step the price for each hub is calculated in both regions on the basis of the regional market coupling algorithms (in the CWE region this is done with the support of the Cosmos algorithm).

After the results have been checked and approved by all the project participants, the **post-coupling processes** can start. These cover shipping activities, the submission of nominations to the TSOs and the distribution of the congestion revenue among the TSOs.

For all these tasks, there is no change within the CWE region. The shipping activities remain as they currently are in the CWE market coupling mechanism and this task will be carried out by Central Counter Parties (CCPs). In addition, the same mechanism is applied for the submission of the

cross-border exchanges within the CWE region by the respective CCPs as is currently used in CWE market coupling. For distribution of the congestion revenues, CASC's Congestion Revenue Distribution System (CRDS) is used. The NWE DA project does not change the calculation method for congestion revenues.

5 NWE procedures

As set out in the previous section, the NWE price coupling process comprises a number of phases (pre-coupling, coupling and post-coupling), for which a number of procedures have been created and are applied. The implementation of each phase requires procedures to be implemented to ensure that the appropriate steps are taken by all the parties and these are carried out in a coordinated way.

The procedures set out here describe the steps to take at NWE level, i.e. those that apply to all NWE participants. Local procedures will include regional procedures (e.g. CWE), bilateral procedures and any other procedure that does not apply to the whole NWE region. The coupling phase is not described by NWE procedures but by PCR procedures drafted by those involved in the PCR initiative.

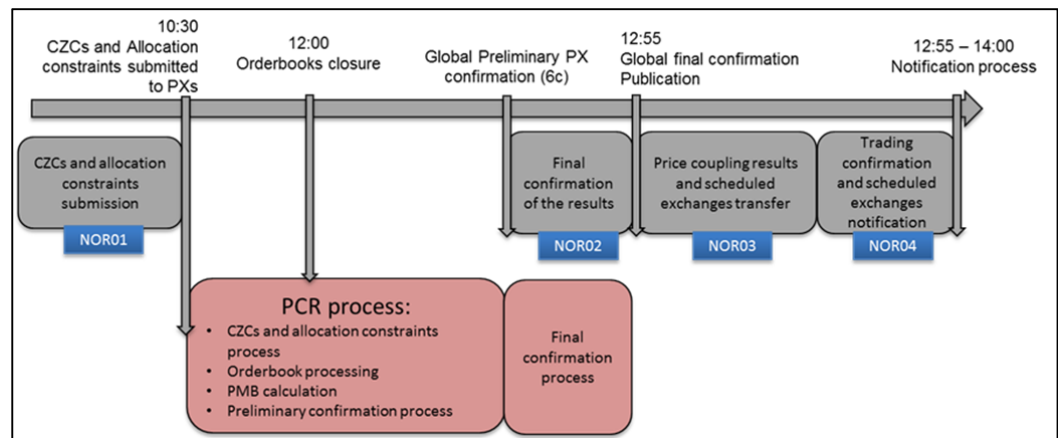


Fig. 3: Overview of NWE normal procedures

The NWE procedures are subdivided into various categories:

- **Normal procedures (NWE_NOR_XX)**

In each phase a number of shared procedures are implemented “under normal circumstances”. For each phase they describe the normal steps that must be taken by the NWE participants in a ‘clear weather’ scenario. Normal procedures are carried out before the ‘Target Time’ is reached.

- **Back-up procedures (NWE_BUP_XX)**

Back-up procedures describe the back-up measures that are available to resolve any technical problems (for instance, submitting a file in another way, e.g. via e-mail). A back-up procedure must be activated as soon as it becomes clear that a specific step of a process cannot be completed within the ‘Target Time’. Back-up procedures will ensure that NWE market coupling can achieve a result without a fallback procedure having to be activated.

- **Fallback procedures (NWE_FAL_XX)**

Fallback procedures are activated when it becomes clear that price coupling results cannot be calculated for the whole NWE region using normal, back-up or special procedures.

- **Special procedures (NWE_SPE_XX)**

Special procedures are carried out when abnormal situations occur on the market (e.g. a second auction) which demand specific measures. Back-up procedures may also be applied during the implementation of special procedures.

- **Other procedures (NWE_OTH_XX)**

Other procedures are related to certain specific expected situations (e.g. the switch to winter time) and to any other circumstance that requires a joint NWE approach (e.g. communication with the market participants in the event of problems with the normal process).

The chart below shows when each procedure will be applied:

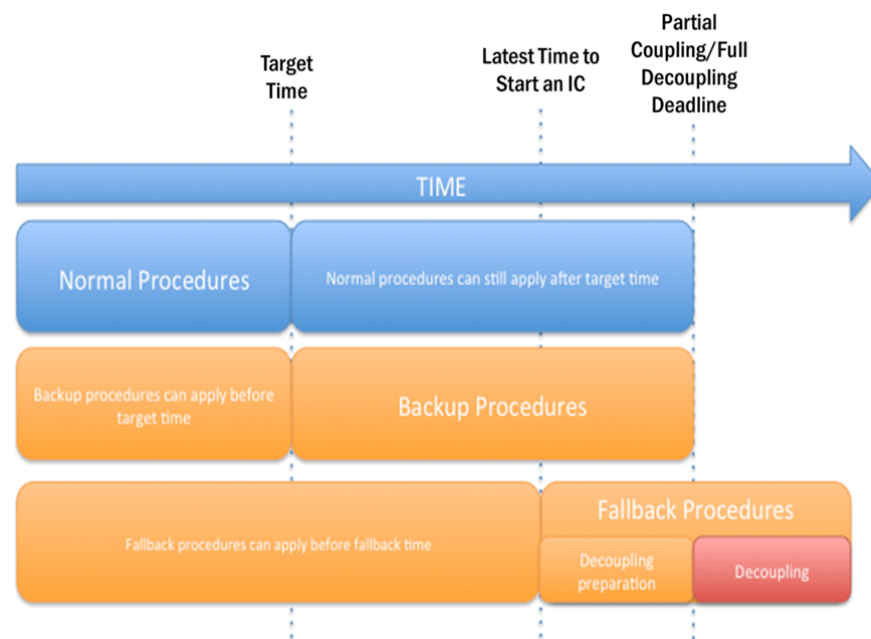


Fig. 4: Overview of NWE procedures

- The 'Target Time' is the deadline for carrying out a normal procedure on a day-to-day basis. Generally speaking, a normal procedure is mostly completed before that time.
- The 'Latest Time to Start an Incident Committee' (or 'Latest Time to Start an IC') is the time when the fallback procedure can be activated, i.e. preparations are made for decoupling. However, it is still possible for the results of the price coupling to be published using the normal and/or back-up procedures before the 'Partial Coupling/Full Decoupling Deadline'.
- The 'Partial Coupling/Full Decoupling Deadline' is a critical time limit for NWE price coupling. After this time, NWE price coupling cannot be carried out and the hubs are decoupled (and therefore capacity is no longer allocated via the NWE price coupling algorithm). A fallback scenario will be put in place.

6 Fallback scenarios

A fallback situation occurs when the NWE price coupling has not achieved any results for the whole NWE region and the switch is made to partial coupling or full decoupling.

Full decoupling in the context of NWE refers to a situation in which for a specific day it is impossible to allocate the CZCs (capacities) implicitly for the CWE region internally, Great-Britain or the CWE-Nordic interconnectors or for the CWE-GB interconnectors. However, the Nordic region will remain internally coupled.

Partial coupling refers to a situation in which no implicit allocation of CZCs can occur for one or more borders or interconnectors, but all other borders and interconnectors remain coupled.

Depending on when the problem emerges and the reason for it, the NWE participants will try to remain coupled to as many borders and interconnectors as possible.

Reasons for resorting to partial coupling or full decoupling may include:

- a lack of the available capacity at an interconnector or border;
- a lack of bids on the part of a power exchange;
- a problem with interpreting the input data in the algorithm;
- no solution being found by the algorithm;
- a failure by the power exchange to allocate the results;
- rejection of the results by the grid operator(s).

You will find an overview of the various partial coupling and full decoupling scenarios in Annex 1.

The associated process times¹ are detailed in the slides that were presented at the 2nd Stakeholder Forum on 14 June 2013 (see Annex 2).

If despite everything, decoupling has to take place, the capacities will be allocated to the market participants in another way. Within the CWE region the 'shadow explicit auctions' system that is familiar from the CWE market coupling mechanism, will remain in place.

At the power exchange, order books will be reopened so that if necessary the market participants can change the bids they have submitted. Subsequently the exchanges will take care of local matching of the received bids, and a price will be calculated.

A decision to undertake full decoupling will be taken at no later than 1.50 p.m. (CET). This is slightly earlier than the time used in the CWE market coupling mechanism (2 p.m. (CET)). The idea behind bringing the time forward is to cover scenarios in which full decoupling is followed by the special case of a second auction (a situation which occurs when intermediate price thresholds have been reached and the power exchanges decide to reopen the order books). In the current CWE market coupling mechanism, this scenario of 'full decoupling + second auction' is not possible in all CWE countries (although it is in Belgium²) due to strict deadlines at the TSOs.

So that the market participants do not miss out on possibilities that are currently open to them, the NWE project participants think that it is beneficial to make these scenarios possible after all. In view of the 3.30 p.m. (CET) deadline for submitting nominations in CWE, the time-frame for submitting nominations was shortened from 60 minutes to 45 minutes and

¹ The process times mentioned may yet change slightly during the simulation tests.

² In the event of decoupling in the CWE MC followed by a second auction at Belpex, Elia allows generation nominations to be received until 3.45 p.m. (cross-border nominations must be received by 3.30 p.m.).

the deadline for deciding to undertake full decoupling was brought forward by 10 minutes.

The market consultation organised by the NWE project participants in March 2013 revealed that the shortening of the time-frame for submitting nominations from 60 minutes to 45 minutes was not acceptable for all the market participants. At a meeting with the market participants in early May 2013 to address the matter at hand, the CWE TSOs were asked whether extra flexibility could be provided for generation nominations, with the market participants requesting that at least 60 minutes be allowed for generation nominations (while indicating that 45 minutes was acceptable for cross-border nominations).

The CWE TSOs and 50Hertz looked into this request by the market participants. In this context, the TSO processes that start when the result of the market coupling is announced were investigated. Following an in-depth analysis of the various processes and links between them and given the importance for the TSOs of receiving high-quality nominations, the TSOs approved the market participants' request, meaning that the market participants will be able to submit generation nominations within the CWE region and 50Hertz until 3.45 p.m. (CET) at the latest. Some TSOs can provide even more flexibility, with Elia extending its deadline to 4 p.m. (CET).

7 Testing

The testing is split up into various phases:

- local tests;
- NWE entrance tests;
- NWE integration tests;
- NWE simulation tests;
- member tests.

In the first phase each of the project participants performed their local tests in parallel. These are tests of new developments and changes in sub-processes (e.g. submission of capacity and shipping), and some of them were carried out with the PMB system. In the same period, PMB tests were conducted in the PCR project. The project participants were asked to also update their local procedures during these tests if applicable.

During the second phase, selected test scenarios will be tested to ensure that the systems are ready to start the NWE integration tests. These selected scenarios include the testing of all technical connections between the NWE test systems, along with the full PCR architecture. Test scenarios encompass a normal, day-to-day coupling session and also a fallback scenario. Both scenarios must be fully implemented before the next phase of testing can begin. The acceptance of all the infrastructure is a prerequisite for this phase.

In the third phase, the NWE integration tests will be performed involving more detailed scenarios. If all these tests are successful, then simulation tests can be conducted by the operators based on the procedures that have been drawn up. These tests will finalise the procedures in terms of timings.

Once these simulation tests have been successfully completed, member tests will be organised with the market participants to familiarise them with the new systems.

8 Rollback

The launch of the price coupling mechanism within NWE, consisting of CWE, the Nordic region and Great-Britain, represents a major change with its new and/or adjusted systems and also its new operational procedures. Even when everything has been extensively tested, a risk of failure still persists when switching from the existing systems to the new ones, not only on the launch day itself but also in the period immediately following the launch. In an attempt to limit this risk, the NWE participants will provide the option in the first two months after the launch of going back to the systems that were in place before NWE went live. For CWE this means that another ITVC calculation will first be performed at the interconnectors with the Nordic region and that CWE price coupling will subsequently be applied based on the Cosmos algorithm.

The decision to activate rollback will be taken by the NWE Joint Steering Committee.

9 Losses on the DC cables

The PCR algorithm will allocate the day-to-day cross-border transactions, taking into account the available capacity and the allocation constraints. The latter may also include transmission losses.

At the request of the NWE regulators, TSOs conducted a study involving an impact analysis of transmission losses being taken into account at the DC interconnectors. This study was presented in April 2013 and submitted to the regulators (including the associated memo from Svenska Kraftnät and Fingrid).

The study evaluates the activation of loss functionality in the allocation of capacity via market coupling and answers the NWE regulators' questions regarding this issue:

- explanation of the maximisation of welfare in the market coupling and the parts of total welfare that are included in the market coupling;
- description of the set-up of the quantitative analysis, the constraints and the welfare results;
- answers to the regulators' questions based on a qualitative analysis complemented by the results of the quantitative analysis.

It goes without saying that if loss factors are activated, this will have an impact on prices and scheduled exchanges in all the bid areas in the NWE region.

The activation of transmission losses at a specific border is subject to approval by the relevant national regulator.

10 Contractual provisions

An operations agreement, called the Day-Ahead Operations Agreement (DAOA), is drawn up between the NWE participants.

The DAOA sets out the principles underpinning cooperation for operational tasks and the rights and obligations of the parties involved.

The agreement only covers the NWE level; all matters relating to the regions falling within NWE or specific interconnectors is dealt with locally based on the contract structure at that level. In other words, the DAOA is a framework agreement that offers the possibility of establishing local arrangements that better match the local constraints existing within a coordinated framework.

The DAOA will be drafted as a flexible agreement so that it can be easily extended to newcomers.

11 Communication

Communication with regulators

NWE has constantly kept all the regulators informed of the status of the project. It has done this in a number of ways:

- three progress reports, sent out in July 2012, October 2012 and March 2013;
- the Final Regulatory Report – this document and its annexes form part of the approval package for the local approval processes; this documentation, excluding confidential information, can subsequently be used by the NWE participants for the local approval process;
- monthly reports indicating the status of the project since early 2013;
- regular presentations at meetings of the ACER Electricity Stakeholder Advisory Group (AESAG) and the Implementation Group (IG).

Communication with market participants

The NWE external communication plan for market participants comprises the following steps:

- publication in February 2013 of an NWE Joint Declaration providing information about the current status of the project on the websites of all the project participants;
- a market consultation regarding the timing of the procedures in March 2013;
- publication of all the relevant documentation online on the CASC website for the TSOs and the power exchanges' individual websites:
 - slides from the two Stakeholder Forums (held in Brussels in September 2012 and in London in June 2013);
 - 'Questions & Answers' regularly updated on the basis of new information and answers to stakeholders' questions;
 - The first, second and third NWE progress reports (excluding confidential information);
 - monthly progress reports for the regulators.

12 Conclusion

Based on the above description and the associated annexes, Elia is requesting approval for the expansion of the geographic scope of the market coupling to the NWE region in relation to the allocation of the commercial interconnection capacities via an implicit method using the Euphemia price coupling algorithm. This approval is being sought pursuant to Article 3.2 of the Guidelines on the management and allocation of available transfer capacity of interconnections between national systems (Annex 1 of Regulation (EC) No. 714/2009), Article 23.2(35) of the Act of 29 April 1999 concerning organisation of the electricity market and Article 183.2 of the Royal Decree of 19 December 2002 establishing a grid code for operation of the electricity transmission grid and access thereto.