Implementation Study Addendum

Addendum to the report for the MoU signatories on the design of the market coupling solution in the Central West European (CWE) region, released by the CWE MC Project in August 2008

November 2008

Contents

1 Introduction

In August 2008, the Central West European (CWE) Market Coupling (MC) Project Parties published the Implementation Study. This study describes the design of the CWE MC solution.

At that time, some issues were still open: they required further analysis and decision making, before presenting them to the stakeholders. This was discussed during the Pentalateral Energy Forum held at September 15. During that meeting, the involved regulators indicated to require more information on the topic of auction income sharing and on the topic of ATC calculation.

The at hand report covers those topics, as well as some additional topics, regardless the content of the Implementation Study, which remains valid. Chapter 2 describes the distribution of the auction incomes in ATC based MC. Chapter 3 describes the methodology of ATC calculation. Chapter 4 is devoted to the results of the latest validation study. In chapter 5 we present the bottom up planning and the budget.

2 Auction income sharing

In market coupling, the auction income arises on a central level, and will be distributed between the involved TSOs.

This chapter describes the distribution key that the CWE MC TSOs agreed upon for the ATC market coupling. The distribution key is compliant with the relevant articles of the Congestion Management Guidelines.

The next sections are devoted to:

- The criteria for sharing auction income;
- The distribution key.

In the light of the decision to switch to flow based market coupling, the CWE MC TSOs will reevaluate the distribution key which goes along with this decision.

2.1. Criteria for sharing auction income

The following assessment criteria, according to the current legal framework and which are necessary in order to fulfil the necessary requirements, were determined by the TSO and are summarised in this chapter. Additionally several issues related to the CWE processes and future developments have been identified.

2.1.1. Transparent and understandable

The distribution of auction income must be transparent and auditable, which means that very complex sharing keys are not preferred. It must be easy to show to the market and the regulators in which way the auction income is shared by the TSOs and how this integrates in the total picture of the auction income cycle.

2.1.2. Non-discriminatory and robust (fairness)

The sharing key should not give room for an optimisation of each share but must be robust, non-discriminatory and fair. With "Robustness" is meant the capacity of reconciling the financial results with the observed physical reality, regardless the volatility of the results themselves. It should furthermore not provide a disincentive to reduce cross-border congestions at the regional level.

2.1.3. Consistency of the sharing

Auction income sharing should be consistent with the auction parameters (in a FB mechanism, they can be flows, prices…) in use; for instance the auction income could be shared, in a flow based approach, according to the calculated resulting flows based on the auction outcome, to have a direct link between the sharing of the income and the way in which the income was generated.

2.1.4. Continuity of income

The current income distribution should not be changed in a radical way in the short term in order to limit the financial impact on all parties.

2.1.5. Compatibility with UIOSI, PTRs

Use-it-or-sell-it principles are set to apply to all explicit auctions in CWE. The auction income sharing will have to take into account this TSOs buy back of capacity at the day-ahead stage. The income flow for each TSO must be compatible between the selling and then buying back of long term capacity and the income generated by the day-ahead market.

2.2. Chosen sharing key

The CWE TSOs agree to use the following key, estimating that it has the best compatibility to the criteria given in the previous chapter.

2.2.1. Reasoning

In an ATC based market coupling only those borders that are congested will see a price difference between the hubs on both sides of that border.

So there are normally only two cases:

- A non congested border with a capacity use less than the given ATC, and no price difference between the hubs on both sides;
- A congested border with a capacity use equal to the given ATC, and a price difference between the hubs on both sides, with the flow going from the lower price area towards the higher price area.

This means that if there is a price difference between two hubs, the ATC given on that border will be fully used; if there is no price difference, there is no congestion, and there should not be any income.

Therefore the auction income which is generated in an ATC based market coupling can be individually determined on each border between hubs. Given the two cases which can occur, in each case could be given by the same simple formula of ATC multiplied by the price difference between the concerned hubs. In the case of an ATC based coupling, another way to formulate it is the additional market flow generated by the coupling (i.e. Bilateral exchanges calculated by TSOs on the basis of market coupling net positions), times the price difference between the hubs.

It is natural that the income generated on a particular border concerning particular hubs, would be assigned to the TSOs which are part of the concerned hubs. So the proposal is to allocate the auction income which has been generated on a border to the TSOs which share that border.

And, in absence of any particular regulatory request for a different sharing, the usual 50/50 rule, which is currently used on all borders in the CWE area, should apply for the 2 sides of the border.

2.2.2. The chosen key: Hub Price Difference x Bilateral Exchanges

The idea of market based keys is that the auction income is shared depending on economic indicators, like clearing prices, or market value of congestions.

The overall auction income is thus distributed depending on economic indicators related to the clearing of the auction, that is to say on market price differences and not only on exchanged volumes.

Definitions:

The "clearing value" is assessed for each border by multiplying the assigned additional flow on the border by the hub clearing price difference. Then these clearing values are equally shared between the TSOs on both sides of the border.

With "Bilateral Exchange" it is meant the additional commercial exchanges resulting from Day Ahead Market Coupling[1].

2.2.3. Calculation

In case of a price difference, the Bilateral_Exchange in a direction will be equal to the ATC in that direction.

For any two TSOs A and B sharing a border

Assigned Income (A) = ½ x Bilateral Exchange (AB) x abs[Hub Price(B)-Hub Price(A)]

[1] On congested borders, this is equal to ATC.

Where Bilateral_Exchange is the exchange from the lowest price area to the highest price area.

For three TSOs A, B1 and B2 sharing a border (A-B), with A on one side

Assigned Income (A) = ½ x Bilateral Exchange(AB) x abs[Hub Price(B)-Hub Price(A)]

Assigned Income (B1) + Assigned Income (B2) = Assigned Income (A)

where B1 and B2 determine between each other how to share the income.

where abs(x) is the absolute (positive) value of x.

2.2.4. Advantages of the proposed key

Working assumption for proposing these sharing keys is that possible disincentives to relieve congestions on borders arising from their usage have not been accounted.

- The key provides the most smooth transition with existing border-by-border schemes;
- The income is linked to arising congestions causing price differences, except for special cases described hereunder;
- It is transparent and non discriminatory;
- It is relatively easy to implement;
- There is consistency of auction income sharing between long term and short term allocations;
- The short term volatility is only related to market price volatility, and ATC volatility.

3 Coordinated ATC calculation

It has been proposed that the CWE market coupling will start using ATC values for cross border capacities, representing the transmission grid. The process to obtain the ATCs and a methodology to adjust ATCs in case of potential security problems has been developed, and some insight in this methodology has been given at the Pentalateral Energy Forum of 15 September 2008. A more profound description of the NTC process and methodology is the subject of this chapter.

3.1. Coordinated NTC process and methodology

The design of the coordinated NTC process and methodology that are proposed to be used in the CWE market coupling is driven by the following objectives:

- to enhance the way in which TSOs facilitate the market and safeguard the grid by striving for an increased level of coordination (at this moment the NTC values are coordinated in a bilateral way between neighbouring TSOs) thereby making a step towards the flow based methodology
- to have an allocation methodology as close as possible to what we have today, both for the market and for TSOs
    - not to confront the market with too many changes in mechanisms in a short period of time, so that the well-known ATCs are the values to be published to the market
    - the implementation of the methodology should be feasible given the tight schedule of the ATC MC.

Those aims led to the following coordinated NTC process:

1. In a first step, NTCs are determined like today, independently by each TSO
2. NTCs are then shared among all CWE TSOs
3. The creation of a common grid model
4. The option to apply the common grid model in order to perform a decentralized grid security analysis
5. In case potential security problems are detected, the NTCs are adjusted in a coordinated way.

The steps of this process are elaborated in the following sections.

3.1.1. Step 1: NTCs are determined like today

Every TSO will continue to apply its current NTC determination procedure in D-2 in order to provide the twenty-four NTC values for its own borders. Existing procedures include a bilateral/multilateral coordination between the neighbouring TSOs of a given border, in order to have agreed values.

3.1.2. Step 2: NTCs are shared among all CWE TSOs

For the CWE market coupling, NTCs are shared by all TSOs of the region in order to determine the area where the Y/M/D-trade should be possible without violating the grid security: this area (or "NTC domain") is defined by all possible combinations of NTC values, which represents simultaneous NTC usage situations.

As an illustration: in case of two borders, there are four possible simultaneous NTC usage situations and the NTC domain is a 2-dimensional space, as represented in the figure 1:

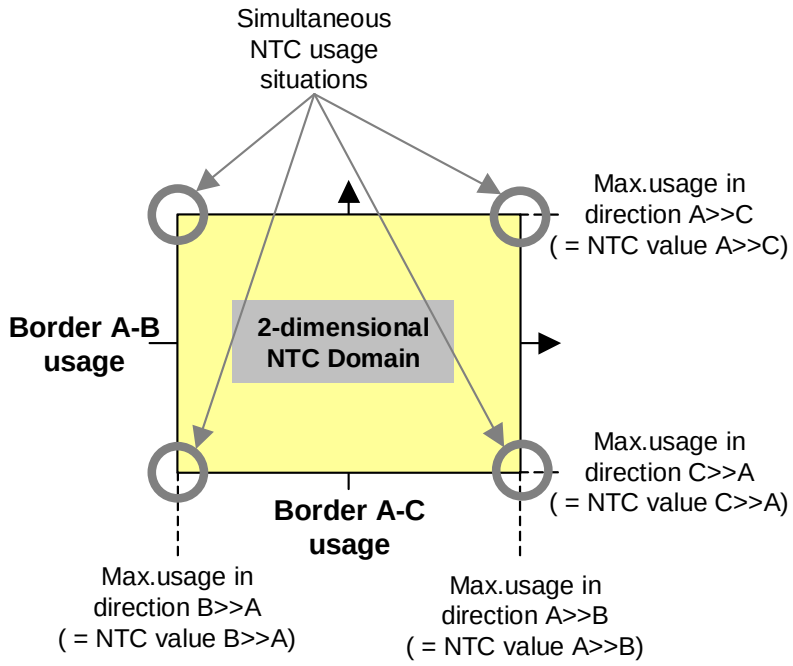


Figure 1: Example of ATC domain with 2 borders

Since the CWE region counts four electrical borders, the NTC domain is a 4-dimensional space defined by 16 ($=2^4$) corners.

3.1.3. Step 3: Creation of a common grid model

For the purpose of verification of the regional NTC values that are proposed, two basecases per day D are created on day D-2: one basecase for peak hours and one for off-peak hours.

The procedure is identical to the D-2CF procedure in the FB mechanism that was explained in the Orientation Study. Some highlights of this methodology are listed hereunder.

Every participating TSO creates, within its own responsibility, a so-called D-2CF-file, that contains the following information:

- Best estimation for:
    - the planned grid outages;
    - the outages of generators;
    - representative load pattern;
    - wind generation;
    - load-forecast.
- As the best estimation for the exchange programs (as they are unknown at the time of the file-creation), the programs of a representative time-stamp are chosen.

For the TSOs that are non-participating in the CWE region, the DACF-files of the representative time-stamp are used for creating the common grid model.

In contrast with the FB methodology, the basecase is not used for capacity calculation, but only for verification.

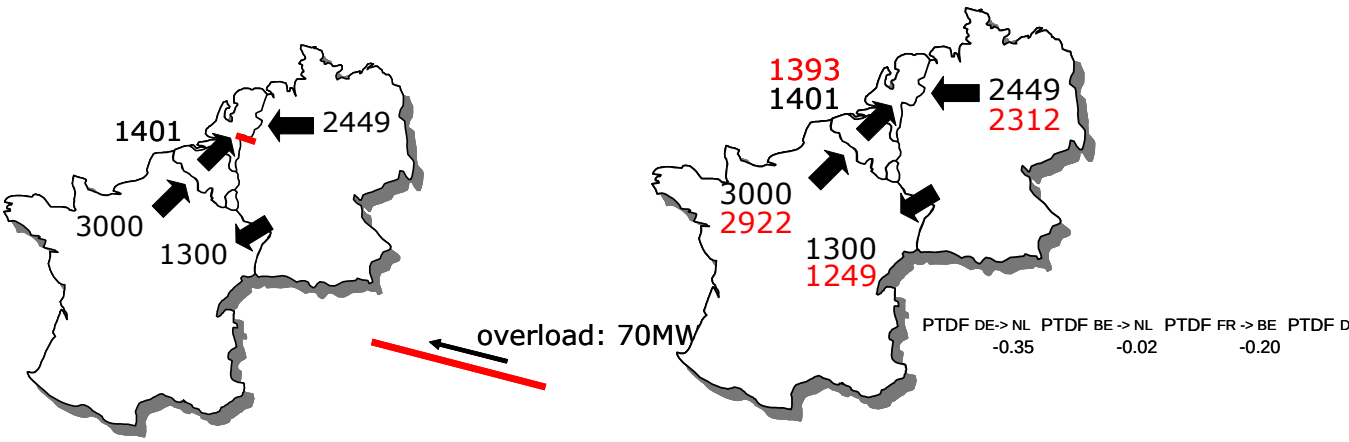
3.1.4. Step 4: Decentralized grid security analysis

Each TSO may use the two basecases to check the security of its grid at each 'corner' of the NTC domain defined in step 2. Basically this means checking that the grid is secure in case of simultaneous full use of NTCs.

3.1.5. Step 5: Coordinated adjustment of NTCs

When a TSO foresees potential grid security problems, an adjustment of the NTC values for the concerned hours is triggered.

Possible overloads should be alleviated by adjusting, in principle, all NTC values. The adjustment will be based on an efficiency key: the borders with the highest impact (in terms of flow-sensitivity) on the overloaded branch will have their NTC be adjusted most. This is illustrated in the example in the two following graphs.



In the left graph, one of the sixteen combinations of the NTC values is used for a grid security analysis. This combination leads to an overload on a tie-line between NL and DE; the overload amounts 70 MW in the direction DE to NL. With the PTDF factors (the power transfer distribution factors for country-to-country exchanges) showing the impact of the various bilateral exchanges on the overloaded branch, we have an efficiency key at hand to use for the NTC adjustment. The PTDF factors of the overloaded branch are shown in the graph on the right; we can see that all exchanges contribute to the overload and will be adjusted in accordance to their contribution. The impact of the exchange from DE to NL on the overloaded branch is the highest (the largest PTDF factor) and will be adjusted most. The impact of the exchange from BE to NL is very small, leading to a minor adjustment of the NTC value on this border. The adjusted values are shown in red in the figure.

3.1.6. Step 6: From NTC to ATC

The long-term (LT) nominations are used to obtain the coordinated ATC values from the coordinated NTC values by using the existing formula (today, this formula is used with non-coordinated NTC values):

Coordinated ATC = Coordinated NTC – Netted LT nominations

The coordinated ATC values are the input for the market coupling system.

3.2. Testing and implementation of the method

During the implementation phase, it is the purpose of the CWE MC TSOs to test and fine-tune the proposed methodology. The tests will follow a step by step approach, starting in January 2009. The first step will consist in testing the creation of the common grid model on a daily basis (week days at the beginning). During the second step, the NTC adjustment process on a daily basis will also be experimented, and in the third step, the ATC calculation will be added.

The results of the testing of the coordinated NTC method are foreseen to be available before the end of Q3 2009.

4 Complementary market validation analysis

As set out in the Implementation Study, reservations were made regarding the TSO and PX data used in the validation analysis. With regard to the PX data, it was explained that the historical order books were not representative since they were not corrected for cross border flows due to explicit auctions. Now, the corrections were made and new analyses were carried out. The purpose of the current document is thus to present the results of the simulations conducted by the CWE market coupling project with the modified order books. The focus is on the benefits of implicitly auctioning the TLC region and Germany (CWE MC under ATC) compared to explicitly auctioning the transmission capacities between these two regions (current market organisation).

The CWE-Market Coupling has been simulated using a prototype version of the Cosmos algorithm (which is the selected algorithm for the CWE market coupling) and taking as input data from modified historical 2007 order books (see below) and historical ATC values.

This chapter explains specifically:

- Why the historical order books are not representative for a CWE MC situation, and how they have been adapted for this second series of simulations. Note that these changes were not made in the Implementation study.
- The benefits of replacing an explicit auction mechanism (current situation between DE-FR and DE-NL) by an implicit auction mechanism, that is, a comparison of the results of the CWE market coupling under ATC and the historical[2] results (TLC+EEX isolated) on relevant indicators, hence the comparison using the same network model with the same capacities, but a different allocation method (explicit and implicit).
- Why the results under FB and ATC have not been compared.

The study simulates a shift from an explicit to implicit auction of the capacity of the German borders, with the assumption that everything else remains unchanged. Due to limitations of this assumption, appropriate reservations are still to be taken regarding the validity of the obtained results.

4.1. Objective of the study

The objective of the study was to determine the increment in quality and value of the coupling of the German- and the TLC-markets based on implicit auctioning of ATCs. To determine these increments a number of quantitative and qualitative indicators have been established which are presented below.

4.2. Simulation data used

The simulations have been conducted with the following input data:

- Power Exchanges : 318 days historical order book data of 2007 (modified as described in the subsections below)
- TSOs: 318 days[3] historical ATC for 2007. (The same capacities were used for the two scenarios –implicit/explicit-, whereas it might be that capacity calculation would be different under CWE-MC (i.e. coordinated ATCs)).

4.2.1. Limitation of the order books

In general, in the CWE-MC, since the market situation will differ from the historical one, it is questionable whether the order books will be the same, and so whether historical order books should be used for the simulations. The simulation results presented in this document are intended to compare two coupling mechanisms: an explicit and an implicit

[2] These results were in fact obtained by simulation with COSMOS using historical data (historical order books of APX, Belpex, EEX and Powernext and historical TLC ATC) and zero capacity between the TLC and Germany

[3] Complete set of input data were only available for 318 days.

auctioning of the daily cross-border capacity available between the TLC region and Germany, i.e. on the DE-NL and DE-FR borders (the NL-BE and FR-BE borders were already implicitly auctioned through the TLC mechanism in 2007, and there is no electrical BE-DE border).

However, currently, the transmission capacities on the DE-NL and DE-FR borders are auctioned via an explicit auctioning mechanism; which mechanism has a potentially large impact on the Exchanges' order books. Indeed, with both implicit and explicit auctioning mechanisms, energy is bought in some markets and sold in other markets, and these transactions have impacts on prices. For example, shipping energy from Germany to France – whether via an explicit or an implicit allocation principle - will tend to increase prices in Germany and to decrease prices in France.

In an explicit auction mechanism, some market participants (especially arbitrageurs) anticipate a price difference between two markets, and submit purchase bids on one market and sell bids on the other (depending on the anticipated direction). This trading strategy is defined as cross border arbitrage.

With implicit auctions, this daily cross border arbitrage is performed via a centralized system, and no longer via the participants' orders.

In Figure 2 such a daily cross border arbitrage is illustrated: arbitrageurs anticipated the market to be high-priced, hence they bought and nominated import capacity, and sold all the imported volume locally. This is reflected by the "explicit import" price taking order in the Supply curve in the figure to the left. Under the assumptions taken (see the following section), the size of this "explicit import" is equal to the nominated imported volume in this market.

The right hand side of Figure 2 illustrates the situation without the explicit import: the price is higher. This is the situation we wish to recreate before simulating the implicit coupling between TLC and EEX: it is from this high isolated price that the coupling (either explicit or implicit) schedules a trade to lower the price (and increase welfare) for the importing market.

Analogously one could create an example where the demand curve of an exporting market contains the exported volume that is bought locally. Removing the explicit export will recreate the isolated situation.

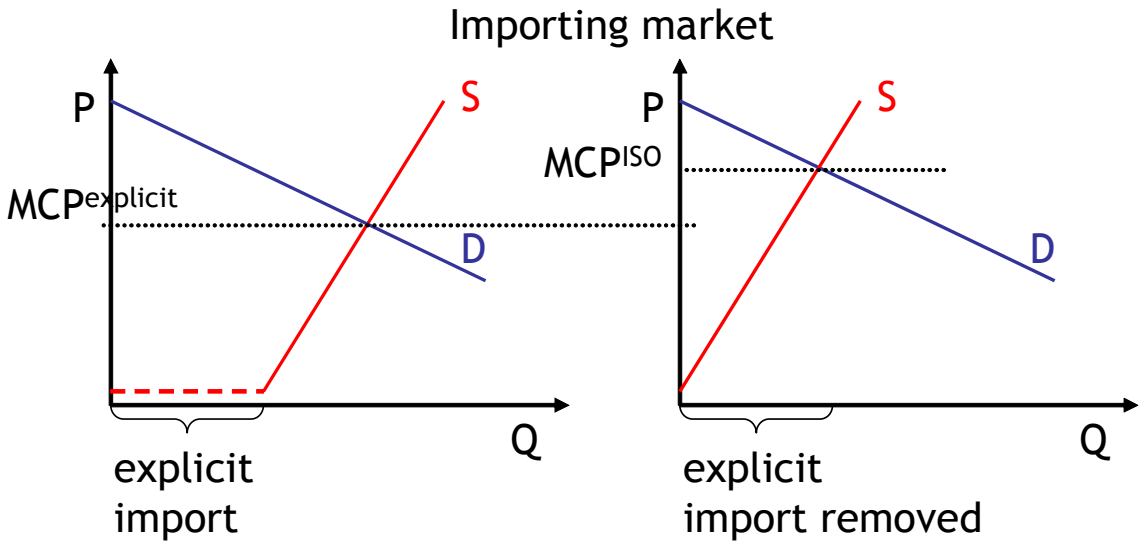


Figure 2: Effect of explicit (import) order in order book

4.2.2. Adaptation made on the order books

The historical CWE order books used for the simulations presented in the implementation study are those collected just after the exchanges gate closure time.

For the reasons explained above, French, Dutch and German order books take into account the effects of explicit auctions on the DE-NL and DE-FR borders as held in 2007, and thus

show prices as reflected in the left hand side of Figure 2. In contrast to the TLC-DE borders, the order books do not contain any daily capacity allocation between the TLC markets.

To simulate an implicit auction the daily cross border arbitrage volume must be removed from the French, Dutch and German order books.

It is very difficult to know the proportion of daily cross border arbitrage in the order books in the TLC+EEX situation, and even more difficult to anticipate the participants' behaviour when moving to implicit auctions. Therefore four assumptions of the reality are made for the simulations:

- All the orders resulting from the daily cross border arbitrages are price-taking hourly orders, but some arbitrageurs can as well submit blocks or price-dependent hourly orders.
- 100% of the daily explicit nominations are used for daily cross border arbitrage in the Power Exchanges (and not in the OTC), meaning that we assume that all the day-ahead capacity is used for daily cross-border arbitrage. If this is not the case, the volume to remove from the order books would then be lower. This approximation is however expected not to be too far from reality, since the Power Exchanges' price in the end is still influenced by the OTC cross-border volume;
- The volume in the order books of long term explicit nominations used for daily cross border arbitrage is not impacted by a change from explicit to implicit mechanism, meaning that we assume that no long term capacity is used for daily cross-border arbitrage. If this is not the case, the volume to remove from the order books would then be higher;
- The overall market participants behaviour will remain the same under an implicit auction mechanism.

Note that the combinations of these four approximations potentially introduce biases in the results.

Therefore removing the daily explicit nominations from the simulation data is equivalent to removing supply (respectively demand) volume up to the daily explicit import (respectively export) volume from the Power Exchanges' order books.

4.3. CWE-MC under ATC vs current situation (implicit vs explicit auction)

This section shows the impacts of moving from explicitly auctioning to implicitly auctioning the TLC region and Germany, under the same ATC constraints.

4.3.1. Benefits of implicit auctions

One can summarize the differences between implicit and explicit auctions by the fact that all the information is available at a central level in implicit auctions, which avoids the step of estimating market conditions and prices. This indeed allows a central entity to compute the best (=optimal) cross-border exchanges by using all the necessary information to do so. Consequently, the final price differences between the coupled markets are optimal, and this is directly observable from the results (i.e. no price differences if no congestion).

In contrast, under explicit auctions, individual market parties must estimate part of the necessary information in order to perform cross-border transactions: because there is no central computation, some information has to be estimated before the price computations. This lack of exact information causes some inefficiency in the cross-border exchanges: the amount of energy bought in some markets and sold in other markets might be too large or too small compared to optimal bilateral exchanges. Consequently, price differences are not necessarily optimal (e.g. price differences but capacities not fully nominated). The first inefficiency of explicit auction is thus the suboptimal usage of the available capacity.

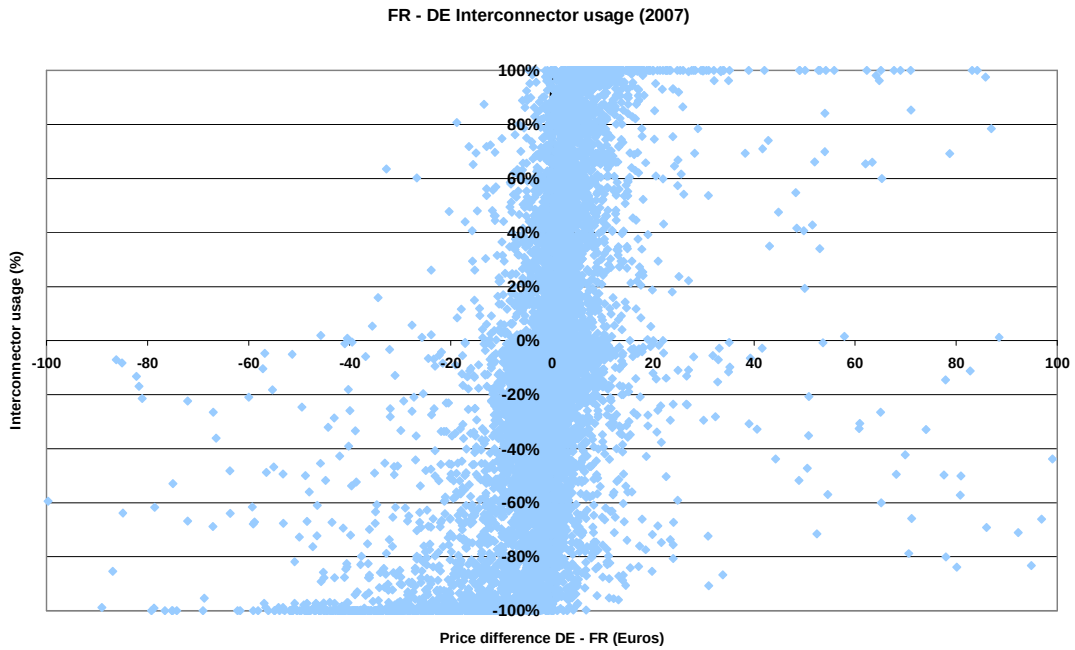


Figure 3: FR DE interconnector usage

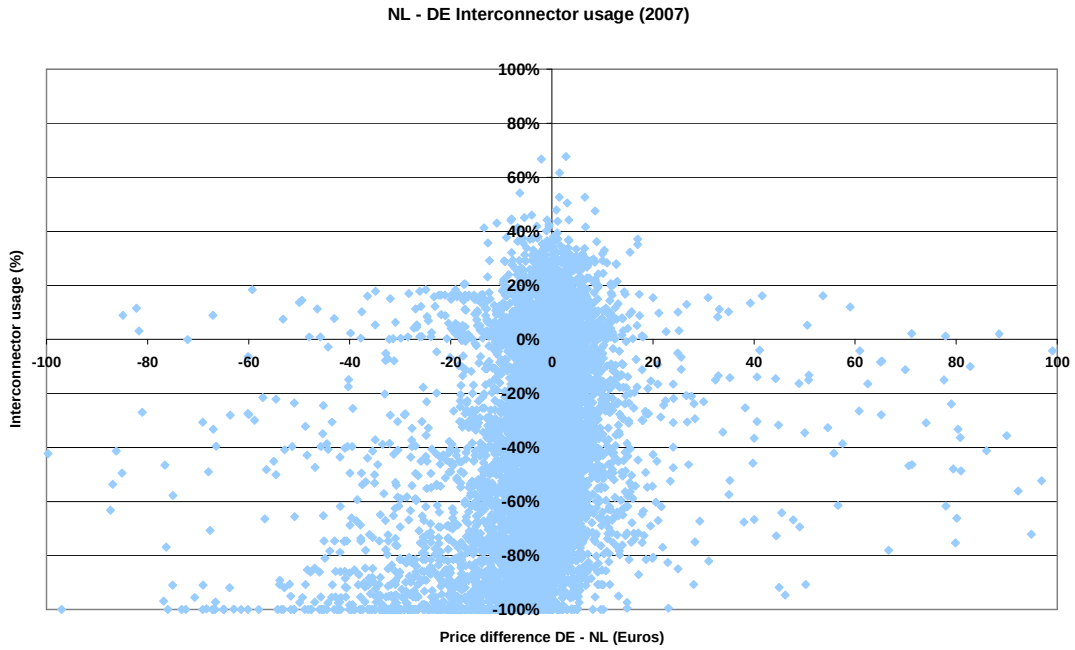


Figure 4: NL DE interconnector usage

In addition, the price of transmission rights auctioned explicitly might differ from the Exchanges price difference. This is where explicit auctions show their second inefficiencies, which is the source of the daily cross border arbitrageurs' revenues.

4.3.2. Results of the simulations

This section explores the impact that the transition from explicitly to implicitly auctioning FR-DE and NL-DE capacities brings on a number of market indicators.

The explicit auction is represented by historical results[4], since these represent the situation where FR-DE and NL-DE capacity was explicitly auctioned.

[4] In the absence of some important indicators (e.g. welfare) for the historical case, this case has been recreated by simulating the TLC with COSMOS using the same historical TLC ATCs and order books, and setting the TLC-DE capacities to zero. Since different algorithms were used, the simulated

Note again that the order books used in the simulations of the historical situation are the historical order books, whereas the ones used in the simulations of the implicit auctions in CWE under ATC are the "modified order books by removing the cross-border trades nominated on the German borders".

4.3.2.1 Indicator: social welfare

Total welfare change

Figure 5 illustrates the difference in welfare between explicitly and implicitly coupling Germany to the TLC markets (FR, BE and NL). The welfare is the sum of buyer surplus, seller surplus and revenue due to price difference between two adjacent markets (mentioned as price spread revenue[5] in the rest of the document) –this revenue is collected by the market participants under an explicit mechanism, and by the TSOs under an implicit mechanism. Note that the large numbers on the vertical axis (337.5 billion euros) mainly represent buyer surplus. This number is somewhat arbitrary, since it mainly reflects price taking demand, which is submitted at the € 3000 maximum price.

Instead, more relevant is the price spread revenue: under the implicit auction this revenue decreases from € 158M to € 134M (compared to the explicit current situation). Nonetheless overall welfare increases under the implicit allocation by **36.4** millions euros (over 318 days).

In Figure 6 the change in welfare between implicit and explicit is subdivided in surplus (buyer + seller surplus), auction income and arbitrageurs' revenue and is presented in a cumulative view. An increase corresponds to higher results for implicit auction; a decrease corresponds to higher results for explicit auction.

Auction income versus price spread revenue

Note that in the explicit case, price spread revenue, defined in this text as the cross border price-spread multiplied by the cross border volume, is not equivalent to auction income, since TSO income follows from the auctioning of explicit nomination rights (equals to "capacity price x sold capacity[6]").

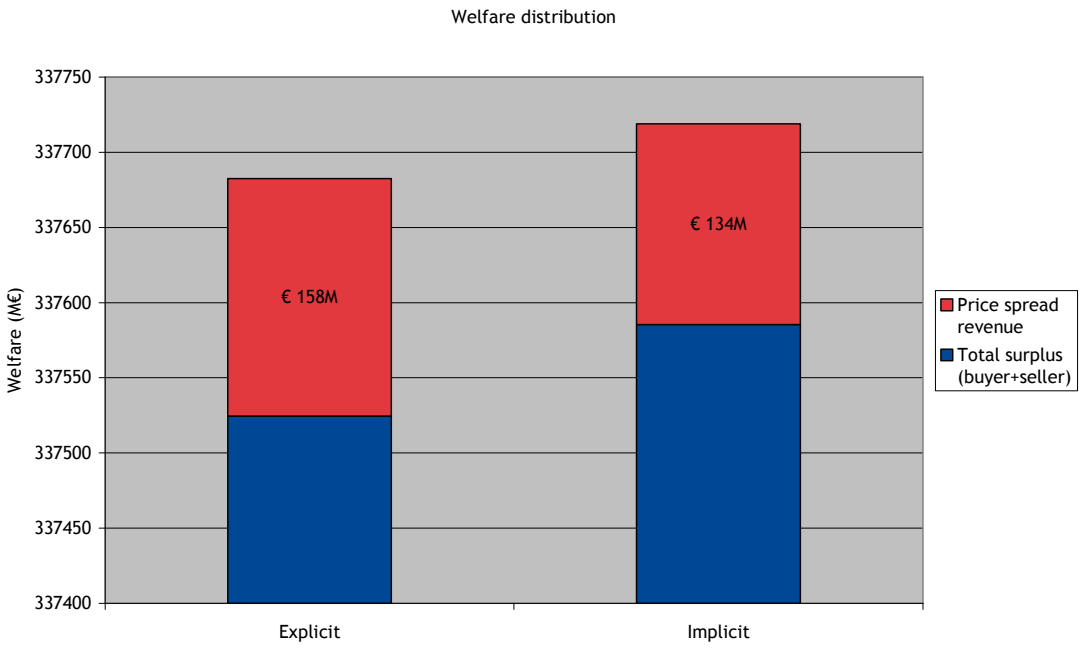
For the explicit case the difference between price spread revenue and the TSO income can be considered to be arbitrage revenue: an arbitrageur can buy cross-border capacity for a price different than the price spread between the markets. Executing his right allows the arbitrageur to make an income of "(mcpto – mcpfrom) x cross-border volume – explicit right x obtained capacity".

For the implicit case, price spread revenue is equivalent to auction income and is commonly called "congestion revenue". For the sake of clarity, this document uses "price spread revenue" and "auction income" without referring to "congestion revenue" as this term does not allow this specific distinction.

historical results differ from the real historical results. However, these differences happen on a limited number of hours, and the impact on the total social welfare is expected to be negligible.

[5] Price spread revenue is computed as sum over all borders and hours of the price differences multiplied by the cross border volume (Auction income plus arbitrage revenue).

[6] Consequently, in the explicit case, the CWE TSO income amounts to the sum on internal TLC borders of the cross border price-spread multiplied by the nominated commercial trade, plus the sum on both directions of the FR-DE and NL-DE borders of the capacity price multiplied by the sold capacity.



Figuur 5: welfare under implicitly coupling TLC and DE

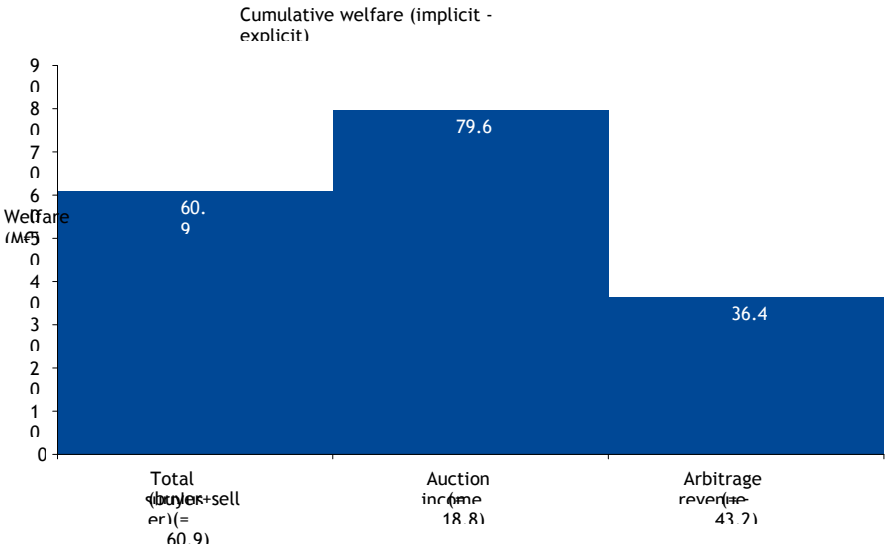


Figure 6 Changes in welfare distribution between implicitly and explicitly coupling TLC and DE

RESULTS

The results in 6 suggest that the total surplus and auction income increase (by 60.9M€ and 18.8M€ respectively) whereas the market participants cross border arbitrage revenue decrease (by 43.2M€) when moving to implicitly auctioning the FR-DE and NL-DE capacity. Overall social welfare increases by **€ 36.4M** (over 318 days).

Price spread revenue: arbitrage revenue and Auction income

The repartition of the revenues induced by the price differences is different under explicit and implicit auctions.

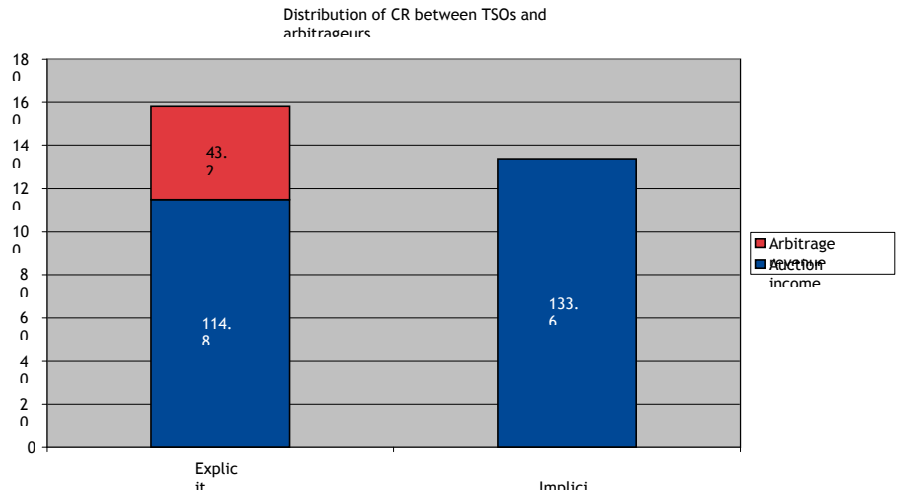


Figure 7 Distribution of price spread revenue between TSOs and market parties

RESULTS

Figure 2 illustrates that under implicit coupling price spread revenue decreases by 24.5M€ (over 318 days).

Figure 7 shows the breakdown of price spread revenue between TSOs and market parties for both the implicit and explicit scenarios: the increase in auction income is of 18.8M€ (over 318 days) from 114.8M€ to 133.6M€, i.e. a 16% increase. This amount does not take into account any additional cost of resale of long term capacity.

Hence the implicit allocation has two consequences. Firstly it reduces the price spread revenue, that is, the revenue due to cross border arbitrages and somehow paid by the community because of scarce cross border capacity. Secondly, this lower price spread revenue is collected by the TSOs.

4.3.2.2 Indicator: base load prices

Annual Base-load prices

The chart below shows the (annual) base-load prices obtained under implicit (CWE-MC UNDER ATC) and explicit TLC-EEX (Historical) auctioning.

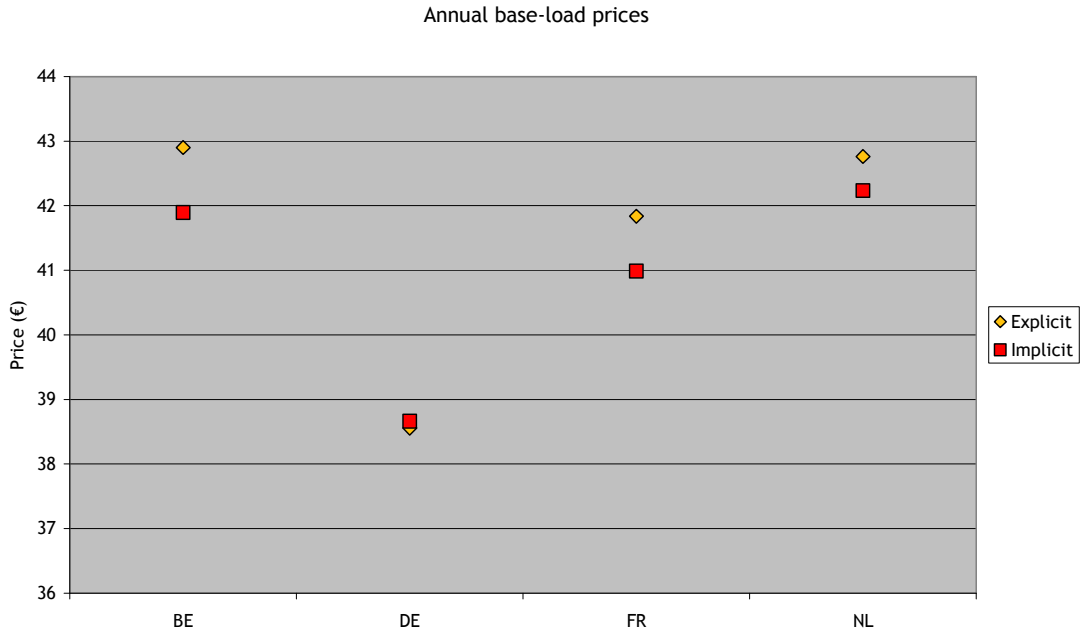


Figure 8 Annual base-load prices

RESULTS

Historically some level of convergence between the markets existed: the spread in annual base-load was mcpBE – mcpDE = € 4.35. Under implicit coupling this spread tightens to mcpNL – mcpDE = € 3.57: on average, more convergence is obtained.

Price convergence

Figure 9 considers the possible price convergence scenarios (i.e. which markets have identical prices). Results are presented as a histogram, with frequencies expressed as number of hours. Prices are considered identical if their difference is less than € 0.01.

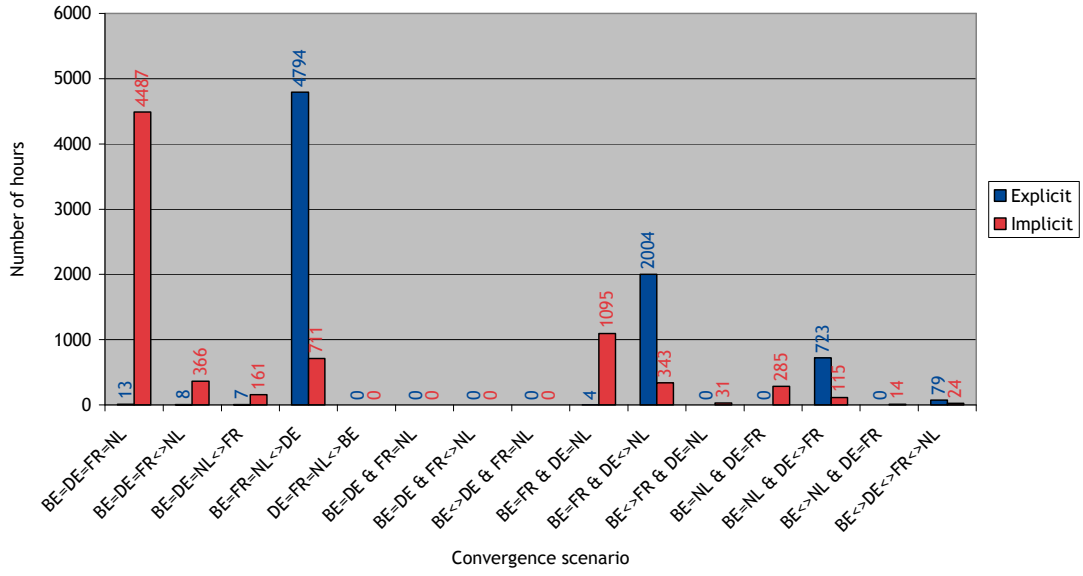


Figure 9 Convergence for historical and CWE-MC UNDER ATC cases. A tolerance of € 0.01 was applied.

RESULTS

The historical result already contains the implicit coupling within the TLC region. This is expressed by the blue spike for the scenario BE=FR=NL<>DE. Implicitly coupling the TLC and DE moves this spike to the full convergence of all four markets. For those cases for which full convergence is not possible the implicit coupling typically results in either a TLC & DE price or a BE+FR and a DE+NL price. Under explicit coupling this latter case typically resulted in a BE+FR and DE and NL price, i.e. no convergence between DE and NL.

In terms of price convergence, the results showed the following:

- There is full convergence (4 Market Clearing Prices equal) in CWE-MC UNDER ATC in 58.8% of the hours.
- There is full convergence (4 Market Clearing Prices equal) in Historical in 0.2% of the hours.
- There is partial convergence (at least 2 Market Clearing Prices equal) in CWE-MC UNDER ATC in 99.7% of the hours.
- There is partial convergence (at least 2 Market Clearing Prices equal) in Historical in 99.0% of the hours.

These results illustrate the superiority of implicit auction over explicit auction: both the historical and CWE-MC under ATC coupled results show good TLC convergence. For the TLC-DE convergence (with a tolerance of € 0.01), the CWE-MC under ATC results are superior.

Price divergence

The figure below illustrates price divergence: the price difference per hour between the most expensive and the least expensive markets. The differences have been sorted in descending order. Results for both the Historical and the CWE-MC under ATC case are presented.

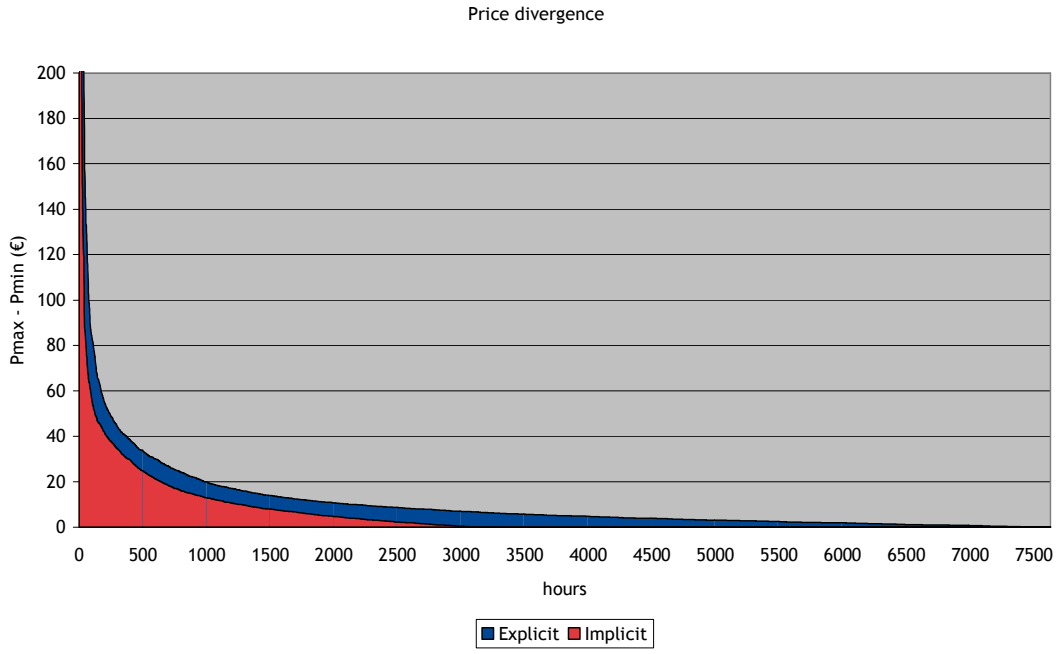


Figure 10 Price divergence

RESULTS
This indicator illustrates that under implicit auctions prices tend to converge more than under explicit auctions.

4.3.2.3 Indicator: volatility

Impact on daily price volatility

A proxy for the price volatility of a market is the standard deviation of the price. Base-load price standard deviations are illustrated in figure 11.

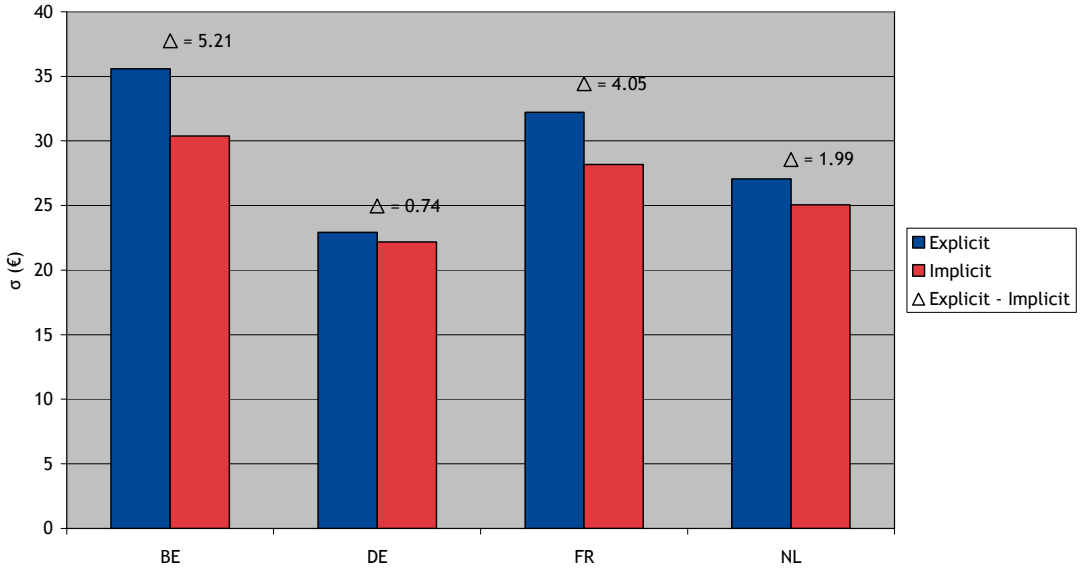


Figure 11 Standard deviation of weekday base-load prices as a proxy for volatility

RESULTS

Comparing the volatility between historical and CWE-MC under ATC shows a decrease for all markets when moving to implicit auction under ATC. In the previous and subsequent section we observed a better price convergence: indeed less extreme values are observed under an implicit coupling mechanism, and the standard deviation is smaller.

4.3.2.4 Indicator: market clearing volume

The graph below shows the market clearing volume for all markets under the historical and CWE-MC under ATC scenarios. Note that market clearing volume is defined to be the largest of either the total demand volume or the total supply volume. The difference between the two is the net position.

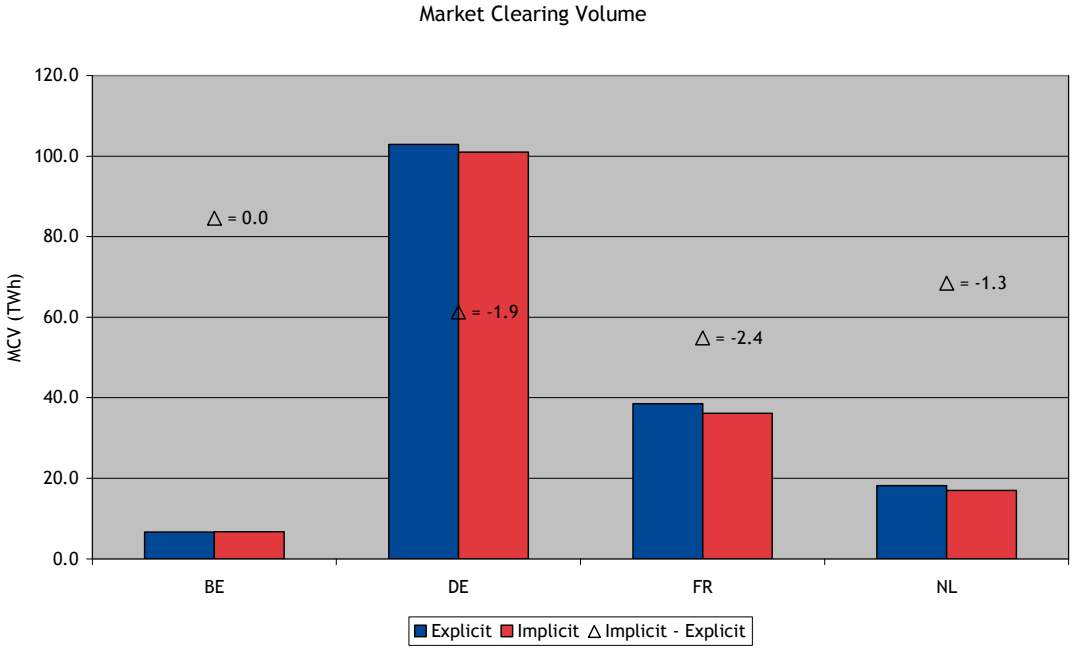


Figure 12 Market clearing volume under the historical situation (explicit) and the CWE-MC UNDER ATC situation (implicit)

RESULTS

Simulation results show that CWE-MC under ATC market clearing volumes never change by more than 7% (NL market). For all markets but BE the change is negative, i.e. the CWE-

MC under ATC scenario less cleared volume is achieved for the Power Exchanges compared to the historical situation.

4.4. ATC vs FB domains: theoretical outline

Under the same grid security level, the ATC domain would be within the FB domain, since a well-tuned FB methodology gives a more accurate representation of the grid security domain (left hand side of Figure 13). More social welfare is then expected to be generated under FB. However, a comparison of the security domains of the historical ATCs and the FB data used for the implementation study, showed the opposite most of the time, i.e. the historical ATC domain often exceeds the reconstructed FB domain (right hand side of Figure 13). Indeed the ATC and FB models used in the simulations do not necessarily represent the same grid security level and have been generated by TSOs in different contexts – operational conditions for ATC and ex post simulations for FB:

- The historical ATC might be overestimated because the ATC domain gives a so far acceptable approximation of the security domain, but that may no longer be the case in the future;
    - This can lead to more stress on already stressed grid situations some days under TLC
    - But it is also possible that some extreme parts of the ATC domain that are not reached in TLC would be reached when coupling with Germany[7]. In that case, more coordinated ATCs could lead to a lower value in the future.
- The FB parameters calculation process must be further improved (many approximations were done) and evolve to a full mature operational system.

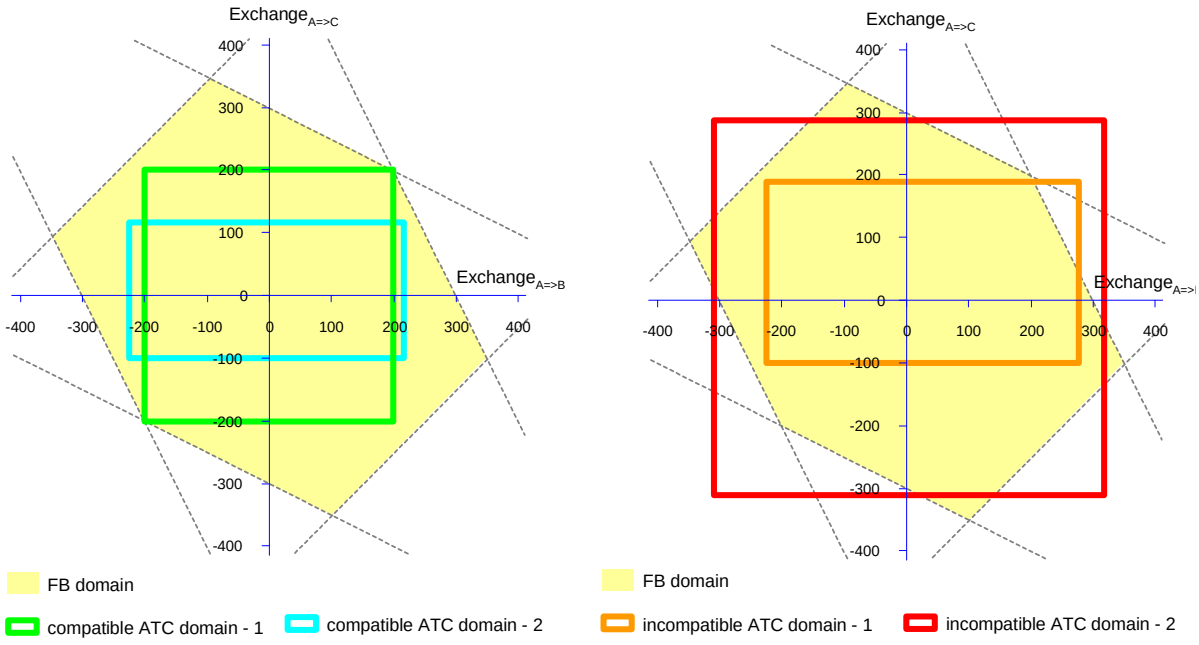


Figure 13 Compatible (figure in the left) and incompatible (figure in the right) FB/ATC domains

We can thus question the relevance and reliability of any comparative study between the historical ATCs and the reconstructed FB dataset; as such a comparison would be based on incomparable data. Such type of study will be conducted once comparable ATC and FB data can be provided, which should be the case during parallel running.

[7] In the current situation, the FR-DE and NL-DE border capacities are not used efficiently because of explicit auctions on the German borders (the market participants do not necessarily nominate the whole capacity they acquired)

4.5. Summation of main observations

Regarding the comparison between the results obtained under implicit and explicit ATC coupling of TLC and DE, the following observations have been made from the simulations[8]:

- Welfare increases by 41.8M€ annually[9];
- Buyer surplus increases under implicit auction;
- Supplier surplus decreases under implicit auction;
- Auction income increases under implicit auction by 21.6 M€[10] annually;
- Price spread revenue decreases under implicit auction by 28.1 M€[11] annually;
- Price convergence improves under implicit auction;
- Price volatility reduces (improves) under implicit auction.

4.6. General conclusion

Before drawing any conclusion from the abovementioned observations, some reservations need to be made regarding the data that is used in the simulations. Indeed some effects of explicit auctions have been removed from the order books used for simulating implicit auctions, but additional effects (see the 4 approximations made) triggered by an implicit auction mechanism may have not been taken into account and have not been reflected in the altered order books. In addition, the same capacities were used for the two scenarios, whereas it might be that capacity calculation would be different under CWE-MC (i.e. coordinated ATCs, or introduction of UIOSI).

Main conclusions from the market validation analysis are presented hereafter.

First of all, the simulation of CWE-MC under ATC shows the efficiency of replacing cross border explicit auctions (historical situation) by implicit auctions. Almost all indicators are improved. The conclusion is that implicit auctions optimise cross border capacity usage and benefit to the community (the prices tend to converge, the welfare increase, the arbitrage revenue disappears). On the other hand, this analysis shows that the implicit auctions do not bring additional clearing volumes to the power exchanges

This report focuses on the benefits of moving to market coupling under ATC in the CWE region and does not show further quantitative results of coupling under FB. Indeed, the historical ATC domain and the reconstructed FB domain (used for the simulations in the Implementation Study) are not compatible, in the sense that they do not reflect the same security level and have been generated by TSOs in different contexts – operational conditions for ATC and ex post simulations for FB.

More generally, the parallel run should provide more reliable data both from market side (order books in an implicit coupling situation) and for network constraints representation.

8 Obviously, the real results during operation will differ from the simulated results

9 36.4M€ increase for 318 days extrapolated

10 18.8M€ increase for 318 days extrapolated

11 24.5M€ decrease for 318 days extrapolated

5 Implementation phase planning & budget

In the Implementation Study, a planning and budget was given, based on a top down exercise. In this chapter, we present the key issues of the implementation phase planning and budget, based on the bottom up exercise. For the detailed overview of planning, we refer to annex 1. It has to be noted that both planning and budget are made under the assumption that regulatory endorsement on the cost recovery mechanism and on the design of the MC solution is given by the 1st of December 2008.

5.1. Planning

In annex 1, the implementation phase planning of the CWE project is mentioned. The overall planning is broken down in the sub plannings of the workstreams, taskforces and subprojects[12].

Based on this planning, the Project parties will start operating the ATC based market coupling on 1st of March 2010. After the launch of ATC based market coupling, the Project Parties will start the parallel running to analyse the results under flow based market coupling. The Project Parties will consult the stakeholders on the results of the analysis, after which the flow based market coupling is planned to start to start December 2010

Building and testing the systems are determining the critical path of the project.

Critical assumptions underlying the proposed planning are:

- Starting date of the implementation phase is assumed to be December 1st 2008 . The prerequisite for this starting date are:
    - Regulatory approval on the proposed market coupling solution as described in the implementation study, completed by the current addendum;
    - Signature of the All Party Cooperation Agreement II, covering the implementation phase, by the Project Parties;
    - The strict prerequisite for the APCA II signature is the firm cost recovery approval by the regulators. Main risk in this respect is the approval by the German regulator towards the 3 German TSOs and EEX.
- Confirmation of acceptance of common gate closure at 12.00;
- Confirmation of the working assumption to have a maximal time span of 20 minutes after gate closure to receive the flows from the Nordic market, allowing for a sequential volume coupling between CWE and Nordic. Currently, the necessary data is guaranteed by EMCC within 30 minutes;
- Timely readiness of the PX systems for integration and simulation testing, in particular the timely completion of the new EPEX Spot system and the CCU and the industrial algorithm;
- Timely completion of the TSO systems for integration. For the joint TSO systems, this is influenced by the timing of the foreseen European Tendering process;
- Positive confirmation of the chosen coordinated NTC methodology through the planned quantitative analysis study during the testing phase and delivering results by Q3 2009
- Agreement on the Shipping Agent solution before end of 2008
- Timely signature of all CWE MC related contracts before the ATC based launch date

The CWE Parties propose to organise an expert meeting between the regulators and a CWE MC delegation to discuss, explain and clarify the details of the implementation study and the current addendum in view of the envisaged regulatory approval. During the meeting, the Project parties intend to focus among other on the details of the planning and the underlying assumptions.

[12] For an overview of the project organisation we refer to the Implementation Study

During the implementation phase of ATC based market coupling, the stakeholders will be informed through quarterly reports. In these reports the Project Parties will describe the general progress of the implementation, the specific achievements and the difficulties encountered. These reports will be published on the following dates:

- End of March 2009
- End of June 2009
- End of October 2009
- End of January 2010

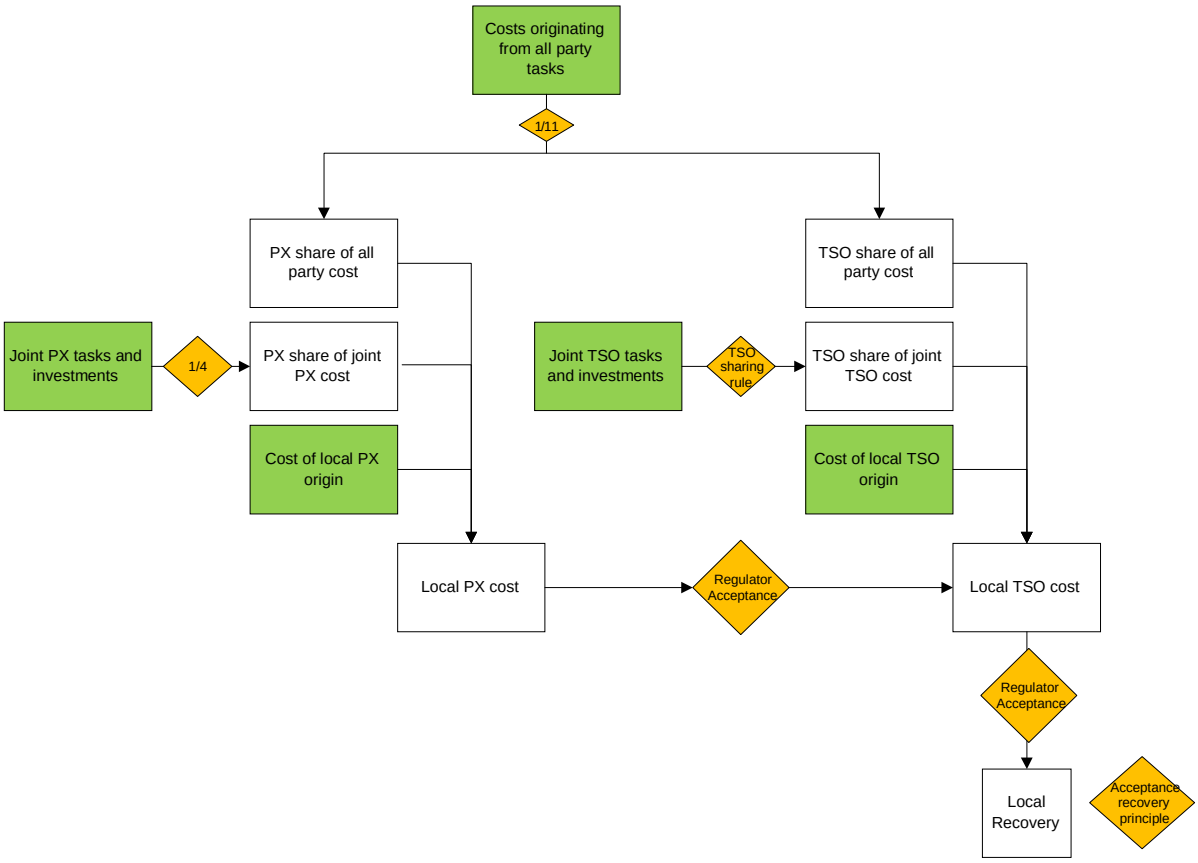
During the period of parallel running, the Project Parties will continue to publish reports on a quarterly basis. The content of these reports will be extended to the results of the flow based validation. These reports are expected in April, July and October 2010.

5.2. Budget

The scheme below presents the proposed cost recovery mechanism. It is shown that costs arise in the green boxes, which represent origins of costs. The budget of the implementation phase of the MC Project is presented according to those boxes:

Costs originating from all party tasks:	6910 k€
Joint PX tasks and investments:	4530 k€
Costs of local PX origin:	4634 k€
Joint TSO tasks and investments	1500 k€
Costs of local TSO origin:	15271 k€
Identified unallocated cost for Shipping Agent setup:	300 k€
Total implementation phase costs:	25696 k€
Actual design phase costs:	7449 k€
Total Project budget:	33145 k€

This budget includes the foreseen costs for the entire project including the implementation of the flow based market coupling. The increase in costs, compared to the indicative budget presented before (26M€) is mainly caused by the 2 step approach that the Project Parties proposed. More details on the local costs can be provided to the local regulator if necessary.


Costs originating from all party tasks
1/11
PX share of all party cost
TSO share of all party cost
Joint PX tasks and investments
1/4
PX share of joint PX cost
Joint TSO tasks and investments
TSO sharing rule
TSO share of joint TSO cost
Cost of local PX origin
Cost of local TSO origin
Local PX cost
Regulator Acceptance
Local TSO cost
Regulator Acceptance
Local Recovery
Acceptance recovery principle