

# Serbia, Montenegro, Bosnia, Croatia: Regional market coupling and national power exchanges projects

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Electricity trade is a multidisciplinary field, which includes a wide range of activities, from the techno-economic calculations to the adequate funds of the financial security of commercial transactions, with the unavoidable latest IT support.

The above mentioned can be best seen by studying the method of "Market Coupling" that, through the electricity market coupling with transmission system operators, leads to more efficient day-ahead trade with an optimum use (available cross-border) transmission capacity. In accordance with the requirements of the network code CACM that deals with congestion management, in Europe there is an intensive trend of unifying the regional applicable mechanisms of market coupling into a single mechanism.

At the European electricity market, on the time horizon for the day-ahead, Market Coupling is rightly regarded as the most advanced form of cross-border trade. Therefore, the European legislation, through CACM NC (Capacity Allocation and Congestion Management Network Code), which establishes the rules of the cross-border electricity trade organization, imposed the Price Coupling as the target model of the future single European day-ahead electricity market. Having passed the audit in the European Agency for the Cooperation of Energy Regulators (ACER), this network code is currently in the process of adoption by the European Commission, after which it will become a European law, legally binding for all EU countries. Coupling the electricity markets represents both a mechanism for matching the bids on the electricity stock exchange and thus, implicitly with it, the allocation of appropriate cross-border transmission capacity. In the paper, the general settings of this method will be presented first, as well as a prominent practical example.

The introduction of this mechanism at the markets of Southeast Europe, which, in accordance with the Charter on the Energy Community is subject to the obligations of accession to the mechanism of Market Coupling, can be expected in the following period, so that the operations on establishing the energy stock exchange in Serbia and other countries in its environment support the fulfillment of such an obligation.

Market Coupling is a mechanism of electricity market integration at the day-ahead level, implemented by the energy stock exchange, and it is organized between two or more countries (their energy stock exchange), i.e. market zones (which can be more than one in one country, and several countries may be in one market zone). This method represents a procedure of implicit auction, which coordinates and connects the electricity trade at the day-ahead level in single operation and implicitly with it the realization of the right to cross-border transmission capacity. Market Coupling includes matching the supply and demand curves of all market zones that participate in the mechanism, taking into account the transmission capacity available for cross-border trade. "Supply curve" of one market zone is

formed by price sorting in a monotonically ascending series of bids for electricity sale (from the bids with the lowest, to the bids with the highest price), while the "demand curve" of that market zone is formed by price sorting in monotonically decreasing series of bids for the electricity purchase (from the bid with the highest, to the bid with the lowest price). Market Clearing Price MCP for each zone and for each hour of the following day is determined at the intersection of the supply curve and the demand curve. The target function of the market coupling is a maximization of socio-economic welfare of the entire market, defined as the sum of welfare of all market participants. The socio-economic welfare of only one zone can be represented as the difference between the cumulative amount of money that customers were willing to pay for electricity and the cumulative amount of money that the sellers were willing to accept respecting the clearing of all market zones in all hours which are involved in the mechanism of market coupling.

The socio-economic welfare can be divided into three categories:

- 1) benefit of the electricity supplier (seller),
- 2) benefit of the electricity purchaser, and
- 3) income from congestion (if there is a congestion, otherwise is = 0)

Benefit of electricity suppliers is defined for the accepted bids for electricity sale and it represents the difference between the income that electricity suppliers receive after the market clearing and cumulative amounts of money which the energy suppliers were willing to accept for their energy. Benefit of electricity customers (yellow / brighter area in Figure 1) is defined for the accepted bids for the electricity purchase and it represents the cumulative amount of money that customers were willing to pay for electricity and the amount of money that was actually paid after the market clearing. The congestion income between the two zones, whose markets are coupling, is defined as the product of the quantity of the electricity stock exchanged between the two zones and the differences in the market clearing prices of these zones. By maximizing socio-economic welfare, market coupling optimizes electricity trade between the market zones which participate in the mechanism: all profitable transactions as a result of matching supply and demand curves are accepted.

The input data for the market coupling calculation and market clearing include a complete set of all bids for sale and purchase of electric energy in all market zones, administered by electricity stock exchange, as well as network limitations obtained by the transmission system operators which can be defined:

- in the form of ATC – Available Transfer Capacity between the market zones, in the case of market coupling based on ATC , or
- in the form of Maximum Flow – MF for each pair “critical element/ critical outage in the case of market coupling based on power flow, where the impact of certain bids on observed critical element is described through Power Transfer Distribution Factors – PTDF.

A list of accepted bids and prices of market clearing are simultaneously determined by the calculation, respecting the transmission limitations defined by the transmission system

operators. In this way, the exchange of energy between two market zones, i.e. value of the allocated transmission capacity is implicitly determined. "Price" of transmission capacity between two market zones is, in fact, the difference between the prices of market clearing of these zones. In particular, if no limit, defined under the constraints of the transmission network, is reached, there will be no congestion between market zones as well as differences in the prices of market clearing, and therefore the "price" of the transmission capacity will be zero and the prices of the market clearing will be the same. Output results from the calculation of the market coupling method, among other things, can include: leveling of market prices for each market zone, a set of accepted bids, income / expense of all market participants, net position for each market zone, as well as congestion in the transmission network and income of the transmission system operators from congestion and the total socio-economic welfare.

### Historical overview of method application and current situation

The method we know today and that is currently in wide practical application in Europe, from Finland to Spain, and from Britain to Italy, began to develop and form in continental Europe in 2001, and based on existing experiences of the NordPool, and the state of the electricity market in that period in Europe and the relevant applicable legislation, from which many professional organizations, experts in various fields (economics, electrical engineering, finance, ...) and academic members of society who worked in applied science, intensely began to deal with creating a practical and applicable method in the given conditions. The main objective was to "engage" energy stock exchange (which would increase their liquidity and modest volume of trade of that time) as essential factors in solving the (technical) problem (arising from intensified commercial activity) of cross-border congestion in order to increase the safety of entire operation of the European interconnection and increase the general welfare of market participants.

### Perspectives for method application expansion towards southeast Europe region

After announcing that the Austrian-Slovenian border will join the European process in the second half of 2015, the borders of the Balkan Peninsula markets have been clearly defined towards the countries in which a unique method of market coupling is applied, where the northern border includes markets of Slovenia, Hungary and Romania. At this point, it should be mentioned that Greece should be the southern border of the region in this sense, where there has been an organized market for more than ten years, in the form of a pool (a variant of mandatory stock exchange), but despite the fact it is a member of the EU, we do not have enough information on their plans for the future integration with the neighboring markets, nor towards the EU - Italy, nor towards their northeastern neighbors.

### Overview of the current situation in Serbia and its surroundings

In the region of Southeast Europe during 2012/2013 the ideas of establishing national electricity stock exchanges were actualized in parallel with the preparations for the final phase of the market liberalization, which, in the majority of countries in the region has started since January 1st, 2015. Practical steps in the stock exchange establishment have made so far Serbia, Croatia and Bulgaria, while Macedonia and Albania have publicly stated

their ideas regarding this issue, in accordance with the recently adopted legal solutions. Last year in Serbia "Elektromreža Srbije" in cooperation with the European Power Exchange EpexSpot started the process of establishing exchanges called SEEPEX (with ownership shares of 75% and 25%, respectively), however the functional company has not been established yet, and according to the latest information it is expected at the end of the third quarter of 2015, as all the preconditions were met by adopting the new Energy Law before the end of 2014. In the same quarter, after two delays, it is announced the start of the stock exchange in Croatia called CROPEX, which is structurally formed in terms of forming a company, but functionally it has not been ready to start working yet. In Bulgaria, after the two companies "competed" for the organization of the stock exchange, the national energy holding obtained a ten-year license to organize the stock exchanges which will be called IBEX and whose beginning of operation is expected in 2015. However, before this stock exchange starts operating, we need to solve the problems of the Bulgarian "export" fee which are still applied to all electricity exported from Bulgaria (currently amounts to € 4.08 / MWh).