Regional Cooperation on the Energy Markets – A Study of Romania's Day-Ahead Market

Corbea (Florea) Alexandra Maria Ioana
Bâra Adela
Uță Adina
Bucharest University of Economic Studies
alexandra.florea@ie.ase.ro
bara.adela@ie.ase.ro
adina.uta@ie.ase.ro

Abstract

In the context of the EU's new energy targets, interregional cooperation is vital. The Romanian Day-Ahead energy market is one of the basic tools in promoting and realizing the internal energy market in the EU, as part of a coupling mechanism at regional level and as such its activities are of particular interest. This paper aims to study the main characteristics and activities carried out on this market, in the context of developing an informatics prototype for forecasting, analysis and decision models for energy providers, to estimate energy demand and generation in a suitable way for an efficient trading on the wholesale energy market.

Key words: energy markets, day ahead market
J.E.L. classification: C88, D47, L94, Q40

1. Introduction

This paper presents a part of the researches on the electricity market in Romania carried out within the "Intelligent system for trading on the wholesale electricity market" (SMARTRADE) project, funded by the National Authority for Scientific Research and Innovation through European Regional Development Fund (ERDF), namely a study of the characteristics, participants and activities of the Day-Ahead energy market.

The Day-Ahead market (DAM) is a component of the wholesale electricity market on which firm hourly electricity transactions are realized, with electricity delivery the day after the trading day (Florea et al., 2017, p.13).

The Day-Ahead market is a vital component of the wholesale energy market, especially due to the transnational activities taking place on it. Starting with November 19th, 2014, the Day-Ahead Market in Romania operates in a coupled regime with markets in the Czech Republic, Slovakia and Hungary through the price coupling mechanism known as 4M MC (OPCOM, 2017a, p1).

The DAM rules establish a centralized market framework for the sale and purchase of electricity by participants in the wholesale electricity market, needed for:

- Facilitating the formation of a wholesale electricity market at national and regional level under conditions of competition, transparency and non-discrimination;
- Establishing reference prices for other transactions on the wholesale market;
- Optimizing the use of interconnection capabilities with neighboring countries by applying their default allocation mechanism.

One of the elements that has garnered a lot of interest lately in the context of the European Union's long term energy strategy is the Regional Energy Policy Cooperation as a way of advancing the EU's energy objectives As it is mentioned in (Dimitrova et al, 2016, p. 1) cooperation and coordination is meant to facilitate the convergence of markets and policies, so while the creation of one EU Internal Energy Market remains the goal, regional cooperation is the

tool with which to achieve that goal. Cooperation could become the stepping-stone towards the completion of the Internal Energy Market within the European 2030 climate and energy framework and beyond.

In (Sandulescu, 2017, p. 1) some of the effects of an integrated market are mentioned such as price convergence, the trading of energy in a single location (on the exchange), the maximization of the overall profit, market volatility, a more consistent reference price, the reduction of market abuse, the elimination of existing risks in the case of separate trading, in the short term, of the interconnection capabilities, as well as the creation of new opportunities for cross-border trading.

The topic of our research project is especially relevant in the conditions in which regional market development through TSO cooperation is essential to the timely realization of the benefits that the Internal Energy Market (IEM) will bring to Europe (ENTSO-e, 2017, p1).

2. Main characteristics of the Day-Ahead Market

Electricity surplus or shortage can be balanced by selling or buying it on the Day-Ahead Market.

Participation on this market is voluntary and permitted to all license holders and economic operators, foreign legal entities that have been granted by the National Energy Regulatory Authority (NERA) the decision to carry on in Romania the supply or trader activity and have concluded with the Electricity and Gas Market Operator in Romania (EGMO) the participation Convention on the Day-Ahead Market. License holders who may become participants in the DAM are electricity producers, suppliers and network operators, the latter only for the purpose of performing the functions mentioned explicitly in the Commercial Code and not for the purpose of obtaining profit.

On the DAM in each trading day, firm electricity transactions are concluded for each hourly trading interval of the next delivery day, based on the bids submitted by the DAM participants. Offers may only be placed in the trading system in accordance with the trading hours set in CET hours and only if the RON price scale is available and the exchange rate for the respective trading day has been published by the Romanian National Bank (RNB). The exchange rate is established on every bank business day. If the day before the trading day is a non-working day respectively Saturday, Sunday, a legal holiday or a day when the RNB does not set the exchange rate, the exchange rate applicable for the trading day is the one set on the last banking day before the trading day. The exchange rate is entered into the trading system by the Energy Market Operator on the day it is established, for all trading days for which it is applicable.

Deals traded on DAM have several distinctive features. Electricity sales / purchase offers are aggregated on the portfolio of each DAM participant. The offer is defined by at least one quantity-price pair. The quantity is expressed in MWh with one decimal, and the price is expressed in lei with two decimal places. Bids are made at CET time, the first trading interval being between 0:00 and 1:00 CET. Offers shall be made for the national supply area, taking into account its operation in a coupled mode or, as the case may be, in a decoupled condition in the last resort. Offers may be of the following categories: deals per one trading session, identified as hourly bids; offers corresponding to several consecutive interdependent trading intervals identified as block bids.

The IT system validates / invalidates the bids submitted by participants in accordance with the criteria set out in the "Operational procedure for setting the format, content, mode of transmission and validation of bids on the Day-Ahead Market".

In the normal situation of coupled operation, DAM transactions are carried out by correlating bid and purchase bids through the auction mechanism established according to the Price Coupling of Regions (PCR) mechanism, following the bidding, validation and aggregation of bids, running of the coupling mechanism, allocation of the coupling results on the participants' portfolios.

3. Activity flows and functionalities

The process of conducting trading on the DAM is described in detail in (OPCOM, 2017a, p1) and (OPCOM, 2017b, p1) and involves going through several successive stages in which both participants and the market operator are involved.

The first stage is the registration of the economic agent as a participant in the DAM. The economic agent must obtain from the National Energy Regulatory Authority the license for: generation of electricity (for producers) or supply of electricity (for suppliers). For this he must do the following:

- Registering as a Balancing Responsible Party(BRP) with the balancing market operator or delegating balancing responsibility to a different BRP.
- Submitting a letter of intent to the Electricity and Gas Market Operator "OPCOM SA".
- Preparing the dossier with the documentation specified in the procedure for registering the participants on the Day-Ahead Market and filing it at OPCOM.
- Signing the participation on the DAM convention.
- Submitting to the Electricity and Gas Market Operator "OPCOM SA" the declaration under its own responsibility in accordance with the provisions of art. Iv pt.1.e) of the Romanian Government Ordinance no. 28 / 27.08.2013 regarding the regulation of fiscal-budgetary measures, and the receipt of OPCOM's declaration on its own responsibility.
- Withdrawal, suspension and revocation of the participation license, where applicable.

The second stage involves the operator of the DAM, which prepares and updates a trading registry. Each DAM participant has the right to consult the information in the trading book that concerns him and to request correction of any inaccuracy.

In the third step, the market operator records the offers during the trading hours until the DAM closing time on each trading day. Bid are transmitted (up to 25 pairs of price-quantity) for purchase and / or sale of electricity on the DAM by the participants. Subsequently, validation of bids entered into the trading system takes place. If necessary, after the validation of the offers, these may be modified or canceled by the DAM participant who sent them, before the DAM closing time. Changes are temporally marked and recorded in the trading system. Bids will be revalidated.

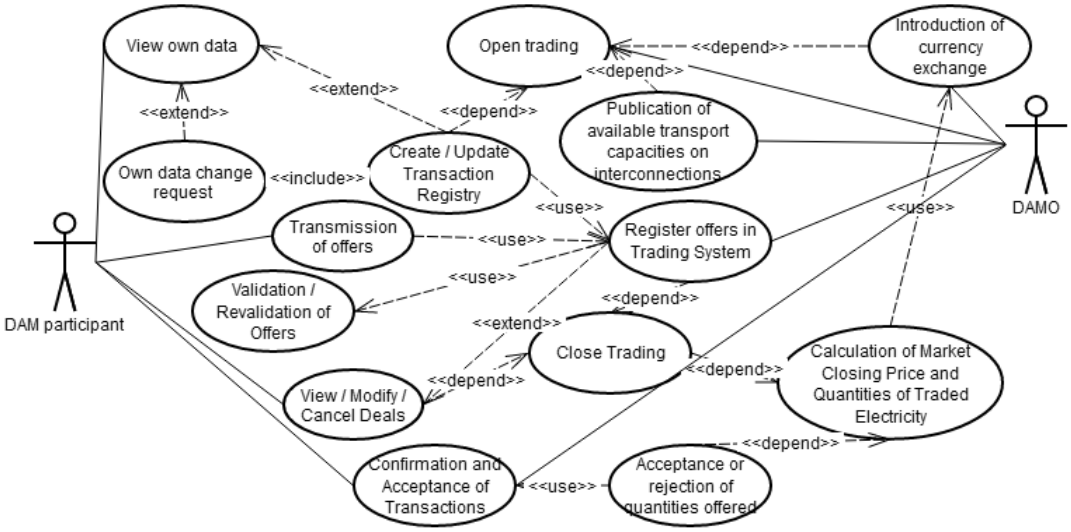
The market operator calculates the MCP (Market Closing Price) and the quantities of electricity traded, for the delivery day (s) and establishes the acceptance or non-acceptance of the quantities of the bids for trading. If MCP is defined, the market operator will accept for all purchase offers all price / quantity pairs, whose price is greater than or equal to MCP, and for all sale bids, all price-quantity pairs, whose price less than or equal to MCP. If MCP is undefined, the market operator will execute the second round of bidding on the DAM for the delivery day in which the closure of the DAM led to an undefined MCP over several trading intervals corresponding to the same delivery day

Confirmation and acceptance of DAM transactions involves:

- The market operator informing each participant in the DAM on the concluded transactions
- Receiving appeals from the DAM participants
- Verifying appeals and submitting results
- The market operator establishing physical notices to be forwarded for verification to each BRP to which the DAM participants belong

Offers are transmitted electronically by the participants to DAM through an electronic interface to the trading system for correlation and execution. In Figure 1 we represented the main activities identified above, represented in the form of trading system functionalities, respectively the use cases of the Use Case Diagram.

Figure no. 1 General Use Case Diagram for DAM



Each of the main activities identified and punctuated in the diagram presented above can be further explained to provide all the details necessary for a thorough understanding of the market mechanism. In the table below (Table 1), we have made a detailed textual description of the process of creating or updating the Trading Registry.

Table no 1.

Use case element	**Description**
Code	UC11
Name	Create / Update Trading Registry
Status	Sketching
Scope	Making Trading Registry
Main actor	Day-Ahead Market Operator (DAMO)
Description	DAMO prepares and updates a trading registry
Precondition	• Open trading period • Economic agent registered as DAM participant: - Obtaining from the national energy regulator the license for: electricity generation (for producers) or supply of electricity (for suppliers); - Recording as a party responsible for balancing (BRP) to the balancing market operator or delegating responsibility for balancing to another BRP; - Submission of a letter of intent to the operator of the electricity and natural gas market "OPCOM" S.A.; - Preparation of the dossier with the documentation specified in the procedure for registering the participants for the next day's market and filing it at OPCOM; - Signing the next-day market participation convention. - Submission to operator of the electricity and natural gas market of the declaration on own responsibility
Postcondition	Each participant to the DAM has the right to consult his own information in the trading registry (View own data) and to request correction of any inaccuracies (Own data change request)
Trigger	Desire of the DAM Participant to participate in DAM trading on a given date
Base flow	Creates a trading registry recording the DAM participants. The trading registry must contain for each DAM participant at least the following: name, registered office and contact details; The date and number of the DAM Participation Agreement; Identification code on DAM; The names and contact details of persons delegated to act on behalf of the licensee; The name, contact details, and identification code of the PRE that has assumed the responsibility for balancing for that DAM participant.

Alternative flows	• DAM participants view their own data, and if there are inaccuracies, they make a request for data modification, on the basis of which the change is made in the trading registry • If a DAM participant waives its participation in the DAM, or if the registration of a DAM participant is suspended or revoked by it is deleted from the trading registry.
Relations	The trading system
Frequency of use	Daily
Business rules	• A DAM participant will be revoked or suspended in the following cases: a) If the DAM participant, no longer fulfills one of the conditions required for registration as a DAM participant; b) If the DAM participant, no longer meets the requirements for the required guarantee or does not make the payments in accordance with the provisions in question; c) DAM Participants that do not comply with the DAM Participation Contract and DAM operation and rules; a. If the DAM participant is repeatedly found guilty of non-compliance with the applicable DAM rules or settlement rules. • If a DAM participant waives its participation on DAM or if the registration of a DAM participant is suspended or revoked by DAMO: • The DAM participant is no longer entitled to submit new offers to DAM and all validated bids are deemed to be canceled; • The DAM participant must make all payments due in accordance with the provisions of the law; • After all payments due by the DAM participant, the DAMO cancels its registration in the Trading Registry, informing the participant to the DAM, TO, BRP-that has assumed the balancing responsibility for the respective license holder and all other DAM participants in connection with this cancellation. • To become a DAM participant, a licensee or a small manufacturer must be registered by the EGMO • Network operators may become participants in DAM and may participate in DAM only for the purpose of performing their functions specified in the law. No network operator has the right to trade on DAM only for the purpose of obtaining a profit • A licensee wishing to become a DAM participant has the obligation to pay the applicable rates • The DAM participant who intends to submit positive purchase offers or offers with negative prices must submit a financial guarantee to the EGMO. • Registration for DAM is made after the registration of the license holder as BRP or on the basis of the evidence of inclusion in a BRP

4. Analytical indices and indicators used on the market

DAM Indices

The Energy and Gas Market Operator has reached an agreement with the Eurex Group - European Energy Exchange (EEX) and Power Exchange Central Europe (PXE) and has obtained the right to use the ROPEX_DAM spot electricity indices. These indices are useful for recording transactions in derivative contracts as well as for trading products in order to mitigate the volatility risk of the Day-Ahead Market price. These indices are:

- *Hourly prices* [lei/MWh] *(ROPEX_DAM_H) - presents the sequence of the 24-hourly values of the closing price of DAM;*
- *Basic price* [lei/MWh] *(ROPEX_DAM_ BASE)* - the daily arithmetic mean of closing prices for the Day-Ahead Market;
- *Base volume* [MWh] - Sum of hourly volumes traded on the DAM;
- *Rates for peak hours* [lei MWh] *(ROPEX_DAM_PEAK*) - arithmetic mean of closing prices for DAM corresponding to peak load hours;
- *Volume for peak hours* [MWh] - sum of hourly volumes traded on DAM corresponding to peak load hours;

- *Price for empty hours* [lei/MWh] *(ROPEX_DAM_OF-PEAK)* - the arithmetic average of closing prices for the DAM corresponding to the unladen hours of load;
- *Volume for Loadout Hours* [MWh] - sum of hourly volumes traded on the DAM corresponding to the load-out hours.

DAM analysis indicators

One of the main analysis indicators for the Day-ahead Market is the one that reflects Price Evolution and Spot Transaction volumes (DAM). Data is tracked on: Number of active participants per day; Number of active participants per month; Volume traded hourly; Volume traded daily; Volume traded monthly; Average volume traded daily; Average volume traded monthly; Monthly Market Share; Value of daily transactions; Monthly transaction value.

In addition, the Sales Market Quotations, Purchase Market Quotas, Volume and Dam quotas (% of Romanian consumption) are also analyzed.

5. Conclusions

The Day-Ahead Market provides the participants with a functional tool to achieve the schedule for the day of delivery, a balance between the portfolio of bilateral contracts, a consumer forecast and technical availability of production facilities. In this paper we have presented the main characteristics of the market, the main indices and indicators and we have detailed the main functionalities of the IT system currently used for participating on the market.

6. Acknowledgment

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7. References

- Dimitrova A, Egenhofer C., Behrens A., 2016. A Roadmap to Enhanced Regional Energy Policy: Cooperation in South East Europe, *CEPS special Report* No. 134/April 2016, [online], Available at <https://www.ceps.eu/system/files/SR134%20Roadmap%20SEE.pdf> [Accessed 10 November 2017]
- ENTSO-E, 2016. *Enhancing regional cooperation*, [online], Available at <https://www.entsoe.eu/about-entso-e/market/enhancing-regional-cooperation/Pages/Regional%20Cooperation.aspx,>, [Accessed 10 November 2017]
- Florea A, Belciu A., 2017, Study on electricity markets in Romania, *DB Journal*, VII (4), p. 13
- OPCOM, 2017, Piața pentru ziua următoare, [online], Available at <http://www.opcom.ro/tranzactii_produse/tranzactii_produse.php?lang=ro&id=1#url> [Accessed 10 November 2017]
- OPCOM, 2017, Indicatori specifici publicaţi de OPCOM SA, [online], Available at <http://www.opcom.ro/opcom/uploads/doc/pg1/calcul_indici_RO.pdf> > [Accessed 10 November 2017]
- Sandulescu M., 2014, The regional energy exchange, ready by the end of the year, the "Energy Plugged In" conference, 2nd Edition, Bursa, [online], Available at < http://www.bursa.ro/the-energy-plugged-in-conference-2nd-edition-mirela-sandulescu-opcom-the-regional-energy-exchange...&s=print&sr=articol&id_articol=247760.html> [Accessed 10 November 2017]