CHALLANGES IN IMPLEMENTING THE LATEST CHANGES ON THE ENERGY MARKETS IN THE EMS/SCADA SYSTEM

PROVOCĂRI ÎN IMPLEMENTAREA ÎN SISTEMUL EMS/SCADA A CELOR MAI RECENTE SCHIMBĂRI DIN PIEȚELE DE ENERGIE

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Abstract: *The transition to renewable energy sources leads to many changes in the energy field, most of them being reflected in the energy markets. This paper presents the challenges faced by the OT team of TELETRANS in implementing some of the changes made in the secondary and tertiary LFC regulation in the EMS/SCADA system.*

Keywords: energy market, imbalance settlement period, IGCC, RTU, PICASSO, MARI, EMS/SCADA

Rezumat: *Tranziția către sursele de energie regenerabilă conduce la apariția a numeroase schimbări în domeniul energetic, majoritatea fiind reflectate în piețele de energie. Această lucrare prezintă provocările cu care s-a confruntat echipa de informatică de proces a TELETRANS în implementarea în sistemul EMS/SCADA a schimbărilor apărute în reglajul secundar și terțiar frecvență-putere activă.*

Cuvinte cheie: piață de energie, interval de decontare, IGCC, RTU, PICASSO, MARI, EMS/SCADA

1. Introduction

In the recent years it has become clear, at least in Europe, if not worldwide, that renewable energy sources are playing an increasing role in satisfying the industrial and domestic electricity demand. In spite of their advantages regarding the positive impact on the environment, mainly by reducing the greenhouse gas emissions, renewable energy sources affect the

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power systems and their operation due to the stochastic or, sometimes, chaotic character of wind and solar power. Thus, the relatively simple load-frequency control that was well documented and that was working reliably in power systems with conventional production units has become a difficult task in today's conditions.

Furthermore, electricity is seen now, more than it was several decades ago, as an asset because of the increase in the price of the energy caused by its scarceness and fueled by the migration towards renewable energy sources. For instance, the switch from conventional (coal or fossil fueled) to renewable power plants is mainly driven by the production price and by the cost of the green certificates. This translates to an increase in the role played by the energy markets even in some fields that were traditionally controlled by technical aspects. One of these fields is the load-frequency control, where the energy markets are going to influence almost everything in the near future.

This paper is centered on that last idea and presents some of the challenges faced by the Technical Support Division team from the OT Department of TELETRANS in implementing in the Romanian EMS/SCADA system the latest requirements driven by the changes in the energy markets. The content of the paper is structured in past, current and future activities and is trying to point out how the market impacts the load-frequency control through the change of the EMS/SCADA system installed at the Romanian TSO – Transelectrica.

2. Past activities

This chapter presents the experience of implementing two major changes of the energy markets: the 15 minutes imbalance settlement period and the connection to the International Grid Control Cooperation (IGCC) platform.

The transition from the 1 hour to the 15 minutes imbalance settlement period has been made possible due to Art. 62 of the Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing [1] and Art. 8 of the Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity [2]. In Romanian legislation the two acts have been translated into the National Regulatory Authority for Energy – ANRE's Order 63/31.03.2020, which came with an implementation timetable for Transelectrica [3]. Since TELETRANS is the administrator and the maintenance service provider of the EMS/SCADA system, its OT Department was given the task of implementing all the necessary modifications to the EMS/SCADA system in operation in order to switch to the 15 minutes imbalance settlement period.

This task had increased difficulty since it assumed calculating the up and down energy for the power plants participating at the secondary regulation, which is used by the Balancing Market to pay the suppliers of ancillary services. Furthermore, the team to which this task was given did not have the possibility to modify the code of the application that was computing the regulation energy for the 1-hour imbalance settlement period.

In order to overcome these drawbacks, TELETRANS' team together with the National Dispatch Center's team have created an external application that computes the regulation energy for the 15 minutes imbalance settlement period. This application uses data recorded with a sampling rate in the order of second by the EMS/SCADA system. That data is extracted from a historical relational database into specific files which are then exported outside the EMS LAN and fed to the new app. To validate the obtained results, comparisons of the energies obtained with the new and old applications were made; these showed that although some minor differences existed, mainly caused by the time required to sample and record data from real-time EMS applications to the relational database and by the number of decimals used, but are negligible due to their small values.

Other tasks needed for the change to the 15 minutes imbalance settlement period required the creation of several files containing data as mean values over the new imbalance settlement period regarding the operation of load-frequency control application, data needed for publication in different reports for transparency reasons. Mean values over the 15 minutes imbalance period for production structure and the interchange power flow had to be calculated; these values had to be shown on a special display (Fig. 1) in the EMS/SCADA system and also transmitted in real-time to other servers in order to be published on different platforms for transparency reasons.

Fig. 1. Part of the custom display created for the 15 minutes imbalance settlement period.

Lastly, some tests regarding the correct interpretation in the EMS/SCADA system of the files transmitted by the Balancing Market were conducted. These tests were needed since the Balancing Market is responsible for sending to the load-frequency controller the schedule for the power plants as well as for the interchange values. Since this data was sent with an hourly resolution, we needed to make sure that the files were correctly generated and that the EMS/SCADA system was able to handle the migration to the 15 minutes resolution.

The connection to the International Grid Control Cooperation (IGCC) platform was required due to Art. 22 of the Commission Regulation (EU) 217/2195 on establishing a guideline on electricity balancing [1] and Part IV of the Commission Regulation (EU) 2017/1485 on establishing a guideline on electricity transmission system operation [4]. The IGCC platform, which operates over most of European TSOs, tries to optimize the use of secondary regulation reserves over a large region covering multiple TSOs. The main idea is that, if a TSO has more reserves activated and another TSO does not, but should have, it is considered that the latter TSO is receiving regulation energy from the first one through a virtual tie line. The working principle of the IGCC platform is described in Fig. 2.

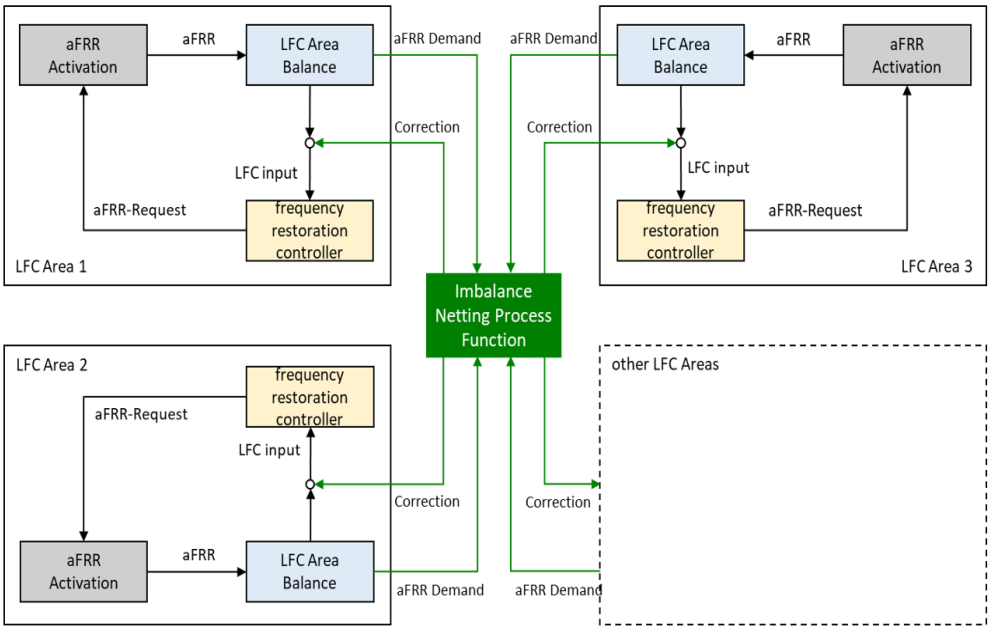
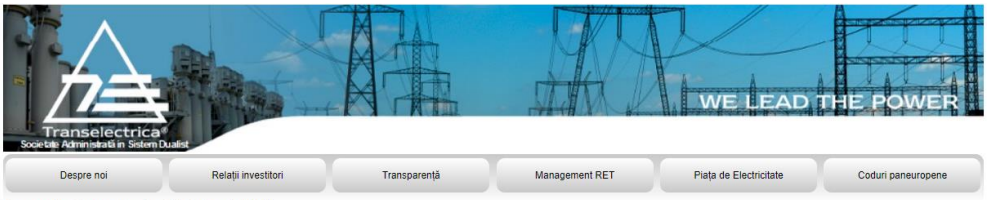


Fig. 2. The working principle of IGCC platform (adapted from [5])

Once again, TELETRANS, by its OT Department, was given the task of implementing the necessary changes to the EMS/SCADA system in order to connect to the IGCC platform. The task was extremely difficult since there was no possibility to modify the load-frequency control program that is part of the EMS/SCADA system. As a consequence, the entire implementation was carried out in the SCADA part of the system and, through clever modelling of the EMS database, the necessary mapping with the load-frequency control program was made, the correction signal coming from the IGCC platform being modelled as a virtual tie line.

Other tasks handled by the team from the Technical Support Division of the OT Department involved the creation of numerous files containing data necessary for different reports made by Transelectrica and for data publishing for transparency reasons. One of the most important files was the one containing the energy transferred between IGCC platform and the Romanian TSO; with the help from the IT Department of TELETRANS, a special page was created on Transelectrica's website (Fig. 3) to publish these values for transparency reasons.



Compensarea dezechilibrelor in cadrul IGCC

Datetime		Export		Import	
Date From	Date To	Energy of avoided aFRR activations	Values of avoided aFRR activations	Energy of avoided aFRR activations	Values of avoided aFRR activations
[EET]	[EET]	[MWh]	[EUR/MWh]	[MWh]	[EUR/MWh]
10.06.2022 00:00	10.06.2022 00:15	6.931	0.020	4.133	707.700
10.06.2022 00:15	10.06.2022 00:30	0.473	n/a	2.196	n/a
10.06.2022 00:30	10.06.2022 00:45	15.789	n/a	0.000	n/a
10.06.2022 00:45	10.06.2022 01:00	6.667	0.020	0.017	707.700
10.06.2022 01:00	10.06.2022 01:15	0.001	0.020	7.155	707.700
10.06.2022 01:15	10.06.2022 01:30	0.000	196.581	12.606	707.700
10.06.2022 01:30	10.06.2022 01:45	0.440	0.020	5.374	707.700
10.06.2022 01:45	10.06.2022 02:00	0.565	0.020	10.484	707.700
10.06.2022 02:00	10.06.2022 02:15	0.000	169.810	15.706	707.700
10.06.2022 02:15	10.06.2022 02:30	0.000	169.810	8.830	707.700
10.06.2022 02:30	10.06.2022 02:45	0.000	169.810	0.562	707.700
10.06.2022 02:45	10.06.2022 03:00	0.000	169.810	0.000	169.810
10.06.2022 03:00	10.06.2022 03:15	3.913	0.020	0.083	707.700
10.06.2022 03:15	10.06.2022 03:30	3.476	0.020	0.311	707.700
10.06.2022 03:30	10.06.2022 03:45	9.715	0.020	0.000	163.473
10.06.2022 03:45	10.06.2022 04:00	3.899	0.020	0.106	707.700
10.06.2022 04:00	10.06.2022 04:15	1.491	0.020	0.841	707.700

Fig. 3. The webpage created for the settlement with the IGCC platform.

One last contribution that TELETRANS had in ensuring the connection to the IGCC platform was the creation of the two transmission

channels needed to transfer data, task handled by the Telecommunications Department.

3. Current activities

The current activities of TELETRANS' team dictated by the changes in the energy markets deals with the transition to the merit order activation in the load-frequency control. This transition is stipulated in Art. 21 (1) of the Commission Regulation (EU) 2017/2195 on establishing a guideline on electricity balancing [1], in the Commission Regulation (EU) 2017/1485 on establishing a guideline on electricity transmission system operation [4] and in the National Regulatory Authority for Energy Orders 89/2021 [6], regarding the procedure on the technical qualifications for ancillary service provision, and 127/2021 [7], regarding the regulation on the conditions applied to ancillary services providers. For TELETRANS, the migration to the merit order activation assumes two main tasks: (*i*) the replacement of the current RTUs installed at the major power plants that participate in the secondary regulation and (*ii*) providing support to Transelectrica in describing the necessary actions in order to modify the EMS/SCADA system in order to support merit order activation instead of pro-rata activation.

The activity of replacing the RTUs is critical in order to switch to merit order activation and is needed because of the moral and physical wear and tear of the old RTUs, because of the lack of spare parts and because of the lack of support and assistance from the manufacturer. In order to facilitate the migration to new equipment, a special and modern model of RTU was chosen – Schneider's MiCOM. Due to its similarities with the old RTUs regarding the acquisition of signals, this new type of RTU will ensure a quick transition. Furthermore, the new RTUs are capable of communicating with both IEC101 and IEC104 protocols and have PLC capabilities.

In order to be prepared to ensure the replacement of the RTUs, TELETRANS had to train a large part of its OT Department members to work with Schneider's PACIS SCE software. This knowledge was needed to be able to configure the RTUs and to model their database. Fig. 4 shows one of the certificates received during the training held in Schneider's Lab in Poland.

Due to its experience in telecommunication field, in EMS/SCADA DB modelling and, thanks to the recent training in using Schneider's software, TELETRANS is now able to offer integrated services to the power plants willing to replace their old RTUs, services that include hardware acquisition, installation, DB modelling, telecommunication channels and maintenance.


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Fig. 4. One of the certificates obtained by TELETRANS team during the training held in Poland.

4. Future activities

New challenges await in the near future due to the changes in the energy markets. These are caused by Art. 21 (1) of the Commission Regulation (EU) 2017/2195 on establishing a guideline on electricity balancing [1] and by the Commission Regulation (EU) 2017/1485 on establishing a guideline on electricity transmission system operation [4] and mainly involve the creation of two new European platforms for ancillary services, namely PICASSO and MARI.

PICASSO, which stands for Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation, is going to be ENTSO-E's (market) platform for secondary regulation services. Since secondary regulation is not enough to ensure the safe operation of power systems and the balance between the power generated and the power consumed, another platform (market) will also be needed – MARI, Manually Activated Reserves Initiative – which will act as ENTSO-E's tertiary regulation services platform.

Huge effort is expected to be needed to modify the EMS/SCADA system in order to connect to these platforms since it will include the change of fundamental apps and the generation of numerous files needed for reporting and publishing. TELETRANS, mainly through its OT Department, will play a major role in these activities in implementing some of the changes as well as in providing help to Transelectrica in defining the software requirements for the EMS/SCADA system.

5. Conclusions

This paper presented the activities undertaken by the Technical Support Division of the Operational Technology Department from TELETRANS in order to implement the latest changes from the energy markets in the EMS/SCADA system installed at the Romanian TSO. The changes made in the energy markets that made the subject of the paper involved the implementation of three ENTSO-E projects: IGCC, PICASSO and MARI. These projects affect the load-frequency control, namely the secondary and tertiary regulation; as a consequence, the application from the EMS/SCADA system responsible with this type regulation (AGC) had to undergo a number of changes.

TELETRANS's team manage to implement the changes involved by the change to the 15 minutes imbalance settlement period and IGCC project, which consisted in the modification of AGC, the computation of certain data and the generation of a number of files necessary for different reports and data publishing for transparency reasons. TELETRANS also invested in the training of people in order to help power plants replace their RTUs to comply with all the signals required by the PICASSO and MARI projects.

The transition to renewable energy sources and the desire to protect the environment is leading to many changes in the energy field and the energy market is playing a major role in shaping the evolution of the regulation and technical specifications. In order to help the energy producers and the TSO adapt to this new power system that is being constructed, companies such as TELETRANS, that manage the OT part, need to permanently invest in training of their employees and to look at the needs of their clients; only by doing so we can ensure the safe operation of the power system.

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