

전력시장 거래를 위한 전력거래소의 IT 네트워크

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Power Exchange IT Network for Electricity Market Transactions

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**Abstract** - This paper explains a network for various participants of the electricity market to make bids on the power exchange. The power exchange accepts bids for various markets such as day-ahead, realtime, and financial over this interface. It exists on the IT plane of the market hierarchy and the participants are able to access it over the internet.

1. Introduction

As the electricity market moved away from the traditional, vertically-integrated system to the competitive market, various market participants are able to bid in the electricity market for profit. The actual financial transaction occurs in the financial market, and the physical power system is takes these transactions into account as it operates. However, there needs to be a layer that bridges these two systems together in order for the electricity market as a whole is to work properly. This paper proposes such a layer, named IT Network, and its basic concepts.

2. The IT Network

2.1 Electricity Market in Layers

The whole electricity market in a nutshell can be explained as a network structure that is composed of a number of layers. Namely, it is composed of the Financial Network, Physical Network, and the IT Network as seen in Fig. 1. Any functioning electricity market can be broken down to these levels.

2.1.1 Financial Network

This layer is what the competitive electricity market opened up for participation. As the market participants trade electricity like the traders in the stock market, all the financial transactions they make are cleared on this network. Usually, the design of the competitive electricity market such as the Standard Market Design (SMD) [1] focuses on this layer.

2.1.2 Physical Network

This layer is the 'real' part of the electricity market, in a sense that the actual flow of the electricity occurs at this level. The operations on this layer are affected by the market conditions and the grid conditions.

Financial Network

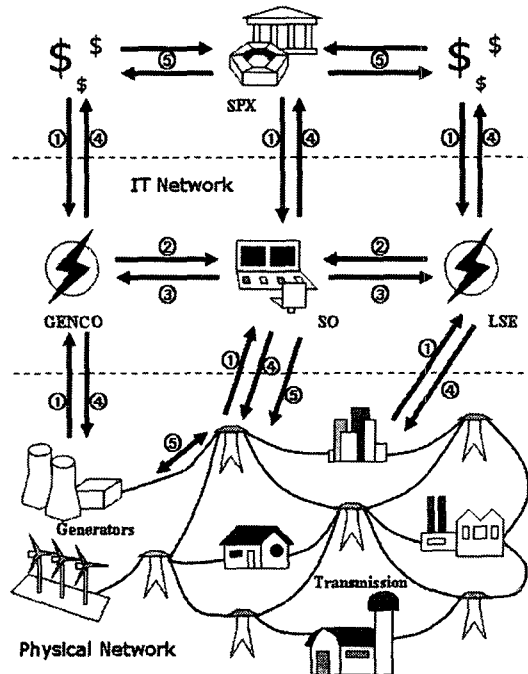


Fig. 1. The three layers of electricity market

The market conditions mentioned here points to the accepted bids and transactions that have occurred on the Financial Network layer. The grid conditions, meanwhile, points to the power system operation parameters such as the generation and loads on the bus, and the possible congestions on the transmission lines.

2.1.3 IT Network

This layer bridges the gap between the Financial Network and the Physical Network. In order for the SO, GENCO, LSE, etc. to make transactions on the Financial Network, they need to know the conditions on the Physical Network. The relevant data would be carried into the Physical Network into the IT Network to solve this need. Also, there must be an interactive interface that links the participants to the Financial Network, as this network is only a virtual layer with only money as the flow.

## **2.2 Operation of IT Network**

The IT Network operates between the Financial Network and the Physical Network as shown in Fig. 1.

### **2.2.1 Network Operation Flow Cycle**

In the first step, the market participants (GENCO, LSE, etc.) and the System Operator (SO) access the status of their managing sector in the Physical Network and the Financial Network through the IT interface. The market participants bid on the market using the information gathered from the status in the next step.

After the bids are closed, SO works out the bids and finalizes what transactions to accept, which is reported back to the market participants. Based on this, the participants and SO update their Physical and Financial Market status.

Finally, Financial Market will settle the monetary transactions on the virtual level (that is, who gets how much is immediately decided; how much is physically paid is not considered), while SO operates the power system based on the results of the transactions accepted. The cycle repeats from step one again.

### **2.2.2 Considering Different Markets**

In the electricity network, three major markets exist: day-ahead, realtime, and financial. All the transactions from these markets co-exist and work together because each of them operate on their respective timeline, and the SO has to merely account for all of the markets at the point of the bid closing of a certain market and consider the bids and transaction requests received.

## **3. Conclusion**

For a competitive electricity market to function properly, not only should the financial and the physical aspects of the market be considered, but the IT aspect should be noted as well. It is shown that, by recognizing the existence of the IT Network, the transactions that occur in both Financial and the Physical Networks can be seamlessly explained.

### **[References]**

- [1] Hogan, William H., "Electricity Restructuring: Standard Market Design and Beyond", CPES-NECA Tenth Annual Spring Energy Conference, 2003