MICROWORLD FOR TRAINING TRADERS IN THE COLOMBIAN ELECTRICITY MARKET

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ABSTRACT

As the Colombian electricity market has moved into a much more competitive environment opportunities have emerged in the trading business. Although this activity can be exercised by a wide number of agents, traders required specialised knowledge of the market to support their decisions making processes and strategies.

ISA, the Colombian Grid Company, and the National University of Colombia, aware of the necessity of the diverse agents in the market, developed a training environment for energy trading in Colombia, from which the sector as a whole can benefit. The most important aspect of the training exercise are the workshops, two which are based on a Systems Dynamics microworld, that provide a good inside of market behaviour under different scenarios.

The microworld user, through a friendly interface, assumes the role of a trader that defines his own strategies under different hydrology scenarios. In this way he will be able to learn about the electricity market before confronting his task under real life situations.

The microworld for training traders presented in this paper exhibits unique characteristics: a) supports developing specific electricity trading capabilities, b) supports developing skills for strategy and risk management, and c) competes with no similar product in the market place.

1. INTRODUCTION

Organisational development is often constrained by the lack of technical and executive training. In general terms, individuals and groups need adequate training in topics related to both risk analysis and corporate strategy, in order to take advantage of market opportunities. Under intensive competition, it would be helpful to count on analysis tools to support training programmes.

In this context, microworlds may be used in the organisation training programmes to explain the organisational environment and for training their members (current

and potential) in all those activities that the company maybe interested to undertake.

A number of microworlds have been constructed, especially in the US and Britain. These microworlds have been used as instruments for learning and training, some of which have been very successful. Perhaps the most well known ones reported in the literature are *The Beer Game* [1], *People Express* [1]*, Oil Producers* [1] and *Beefeater Restaurants* [2], (see also Langley and Larsen [3] for a brief description of most of them).

This paper presents a microworld built to support training traders in the Colombian electricity market. In the following sections we briefly present the motivations for training electricity traders in Colombia, the microworld developed to support training sessions, some of the most important software features and some general ideas with respect to the work-shop developed for training traders.

2. TRAINING ELECTRICITY TRADERS IN COLOMBIA

Some of the major problems that electricity traders are confronting in Colombia have to do with their poor knowledge of the market, its rules, its participation mechanisms, and the decision making process. Particularly, small utilities and generators, along with new incoming companies, lack of analysis tools for dealing with the market uncertainty and dynamics.

We have conducted research aimed to specify a microworld for training agents in the Colombian electricity market. First, we enquired about the different activities taking place in the market, including generation, trading and investment. Trading was selected because it involves almost all agents in the market. *Trading* means buying electricity for sale to both final users and/or other market agents. Buy and sell can be performed in two different ways: using bilateral contracts and in the electricity pool.

In the next section we present the microworld developed to support the activities related to training traders for the Colombian electricity market.

3. MICROWORLD SPECIFICATION

The microworld is specified with respect to information, software functionality and interfaces with other computational tools. Analysts need to work together with senior managers (of the system to be simulated) during this stage to secure model reliability and accuracy.

The system representation of the trading business is shown in Figure 1. Traders have to take into account market pool behaviour, contract market, and current regulation. Both pool market and contract market are constrained by regulation

policies. Moreover, energy availability has an effect on pool and contract prices. Finally, we have to include in the model two customer markets: large users (free market access) and small users (regulated). The microworld includes the trading business, competitors and final users in order to represent the electricity market.
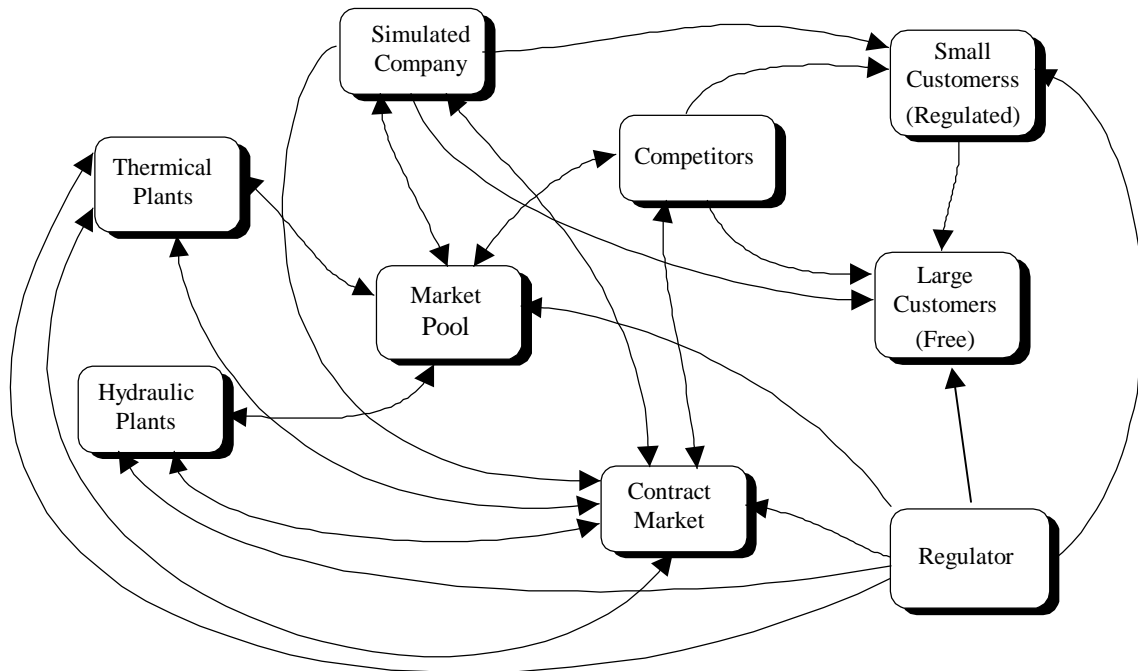

Figure 1. System Abstraction for the Microworld

Functional Features

The microworld should teach agents about the rules of the market and should also help providing insights into the market. These objectives should be achieved through specific functions, as shown below.

Simulation Control

This group of functions will allow simulation runtime control. It includes:

- Simulation timestep: It is quarterly. Total simulation time is 10 years. It is not practical to exceed a total amount of 50 timesteps, since each timestep requires a decision making process.
- Ability to stop a simulation run and to initiate a new one.
- Time indicator showing the total time being played.

Decision Making

Initially, the user could have two possibilities for policy making within the organisation. It includes marketing and managerial decisions, as shown in Figure 2. Moreover, he has the possibility of defining operative decisions such as amount of electricity to be bought and sold.
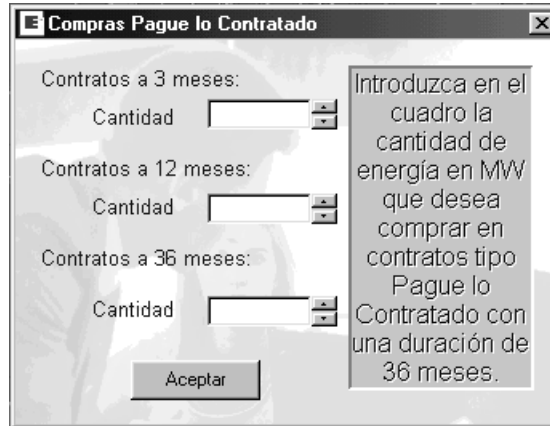
Figure 2. Company decision window (Take or Pay contracts)

Quantity of electricity bought can be specified. Similarly, for electricity selling the player can define the reference price and quantity for each kind of contract. For selling, the structure of the model being represented determines the adequacy of price (related to the market), so that there is a possibility to lose market share. Figure 3 is an example of what the platform looks like.
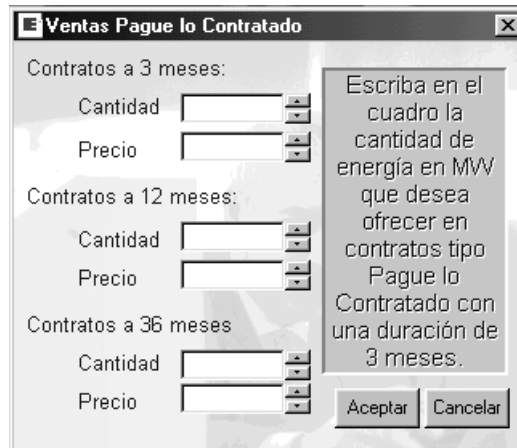
Figure 3. Electricity selling decisions window.

Individuals being trained will see the evolution of the system (step by step) by way of graphic, table and documented sources, which provide partial performance results.

Scenario Definition

The Colombian electricity market is highly dependent on weather conditions - mainly "El Niño" events, which cause sharply increases in price volatility. The microworld deals with this situation by scenario analysis. Proposed scenarios include three weather conditions with wet and dry ("El Niño" ocurrences) periods along ten years of simulation.

Strategy and portfolio management

The microworld is intended to teach basics concept about corporate strategies and risk management applied to electricity market. Some theoretical issues are explained and practised through work - shops that make use of the microworld.

On-line Help

To achieve a better understanding of the microworld, the simulator has to provide help options in each one of the following categories:

* Computational help
* On line help to support specific options of the game
* System behavioural help.

User Feedback Mechanisms

This function is intended to provide full information about the company's performance during the simulation. Reports (tables, graphs, and documents) as well as messages related to individual step-by-step company's performance belong to this function. Possible goals of the system must be established ex-ante in order to provide feedback messages to reflect the players' performance after each step of the game. Figures 4 and 5 show typical results of simulation sessions.

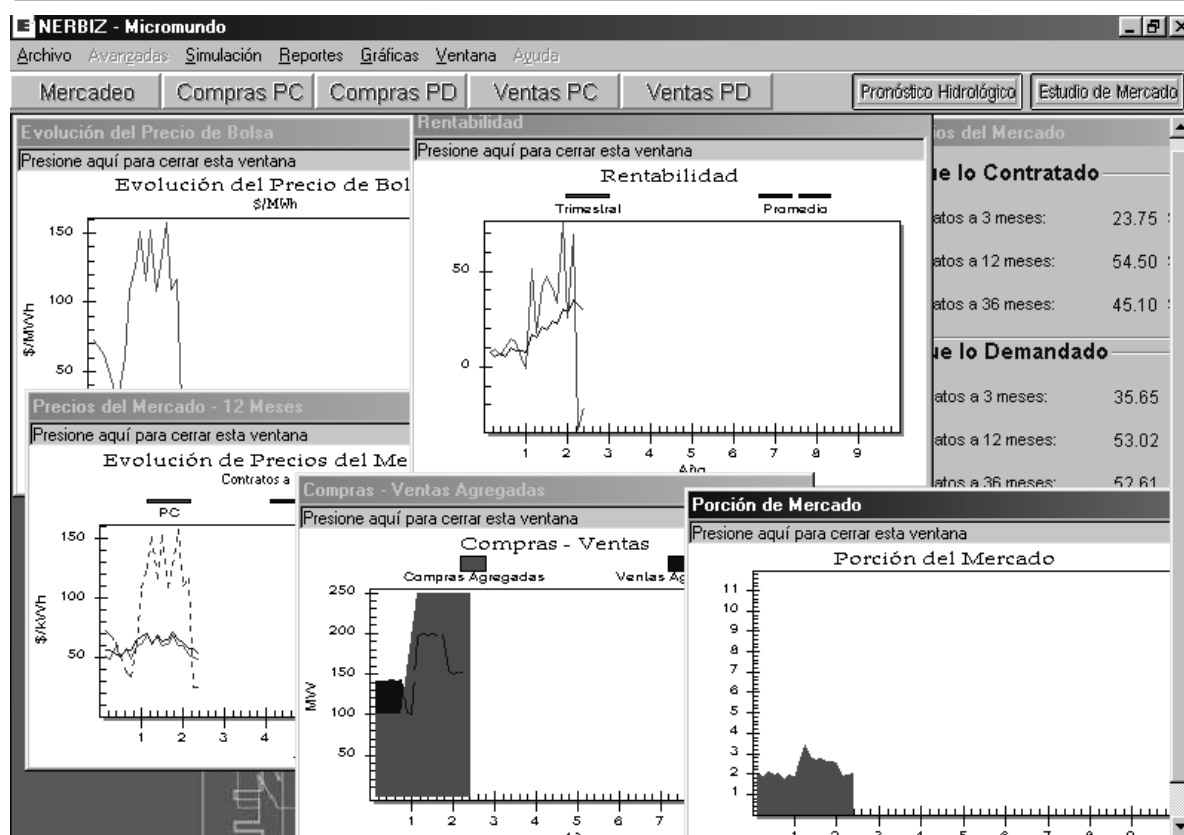**Figure 4.** Some numerical results from the microworld.

Figure 5. Some graphic results from the microworld.

Causal Diagrams

This function allows the user to observe causal diagrams that explain how the simulated system works. Moreover, an explanation of each variable should be provided by the causal diagram and the corresponding relationships.

4. TRAINING TRADERS

The work - shop for training traders lasts two days, during which, the trainees undertake different activities such as conferences, guide shops and games with the microworld. The structure of the work - shop consists of three modules.

The first one consists of a series of conferences, which explain the electricity market in Colombia and its main features. Electricity trading is explained (what type of decisions are involved and its inherent complexities). Basics concepts about corporate strategy and risk management in energy markets are also explained. The first module includes a session where electricity trading through contracts is illustrated and some practical exercises are conduced. This first

module concludes with two cases which illustrate electricity trading and the consequences of making incorrect decisions.

The second module shows the use of the microworlds. The suppositions adopted in the model are presented and the way in which the trainees can handle the microworld is explained trough theoretical and practical sessions.

The third module consists on playing the game. The trainees play two games, which can last each one from 2 to 3 hours approximately. Each game is conformed by three phases. In the first one, trainees should think about corporate strategy; they must identify clearly what their objectives are (to increase shared market, to make growing utilities). In the second phase, trainees undertake their strategy (defined in the first phase). In the third phase, trainees have a final discussion about the game and corporate performance. In this way, discussions with other trainees help to reinforce learning.

Practical tests

The work - shop has been proven with undergraduate and postgraduate students, besides executives from some electricity trading companies attended the first work – shop.

5. CONCLUSIONS

The purpose of this research was to specify, design and develop a microworld for the Colombian electricity sector. In addressing this issue, we believe that microworlds are important for supporting training and learning processes of the current and potential agents.

Initially, the microworld is intended to focus on organisational learning about activities related to electricity.

Trading strategies require technical training. In Colombia, traders lack of strategic support and also have to confront all those entry barriers put in place by the incumbent companies. They have to look up for new products and services, and we believe that microworlds would be an important aid towards this end.

The initial tests undertaken with this microworld indicate their potential usefulness to companies. They can learn new concepts in trading: risk and strategy.

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