EFFECT OF THE BIOMASS ON THE ANALYSIS OF ELECTRICITY PRICE

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ABSTRACT

This paper deal with analysis of electricity price and affect biomass on analysis. For purpose to research was used MACD analysis. MACD prediction mechanism predicts the price trend of electricity on the basis of the indicator MACD. This way it is possible to predict the price of electricity. The conclusion of this research is whether biomass affects the analysis of electricity prices or not.

1.   INTRODUCTION

Biomass, as a renewable energy source, is biological material from living, or recently living organisms. As an energy source, biomass can either be used directly, or converted into other energy products such as biofuel.

Biomass can be converted to other usable forms of energy like methane gas or transportation fuels like ethanol and biodiesel. Rotting garbage, and agricultural and human waste, all release methane gas also called "landfill gas" or "biogas." Crops such as corn and sugar cane can be fermented to produce the transportation fuel, ethanol. Biodiesel, another transportation fuel, can be produced from left-over food products like vegetable oils and animal fats. Also, Biomass to liquids (BTLs) and cellulosic ethanol are still under research [1].

This article focuses on the analysis of electricity prices. The analysis was performed on several data. The result of this research will determine whether connection biomass affects the analysis of electricity prices or not.

Biomass, on the other hand, absorbs atmospheric carbon while it grows and returns it into the atmosphere when it is consumed, all in a relatively short amount of time. Because of this, biomass utilization creates a closed-loop carbon cycle. For example, you can grow a tree over the course of ten or twenty years, cut it down, burn it, release its carbon back into the atmosphere and immediately start growing another tree in its place. With certain fast-growing biomass crops such as switchgrass, this process can occur even faster [1].

This article focuses on the analysis of electricity prices. The analysis was performed on several data. The result of this research will determine whether connection biomass affects the analysis of electricity prices or not. The analysis has been applied over the years during which the resources such as biomass to be connected.

2.   LIBERALIZATION OF ELECTRICITY MARKET

Electricity is one of the commonly traded commodity exchanges. It has some disadvantages but ultimately it can be said that it is traded like any other traded commodity. The difference is that it is unstorable. This is the reason why electrical power is different from the majority of other commodities. In the past, electricity trade was easier. With the advent of liberalization, the electricity market is more complicated. The advantage of liberalization is that each customer can choose his electricity supplier. For comparison, in the past, the Slovak Republic worked three largest electricity suppliers, who were also the distributors of electricity. Currently, however, many electricity suppliers were established for the last few years in Slovakia [2, 3, 4].

The number of changes demand points changed electricity supplier was 76,881 from 2008 to 2011. The reason for the change of an electricity supplier is the price of electricity, which varies from one electricity supplier to another. Due to the higher number of participants in the electricity market, it can be assumed that more subjects affect commodity price. The place which reflects the behaviour of all market participants is called an exchange [3, 4].

Similar to any products, the trading of electricity consists of buying and selling of energy. The trading of electricity exists since utilities companies were originally formed. Nevertheless, the main difference between trading of electricity during, that time and now is that consumers have freedom of choice between suppliers [5].

3.   POWER EXCHANGE CENTRAL EUROPE

The wholesale market for electricity can be seen as the direct result of the separation between transport and production. This new status of electricity involves the development of novel types of contracts for electricity trading. These contracts can either he sold on the bilateral market or on an organized market. They can also be physical contracts (for delivery) or financial contracts (hedging). However, all of them share three characteristics: a defined period, a certain amount of electricity, and a price. The other characteristics can differ widely [5].

The Power exchange central Europe (PXE) established in July 2007 offers power trading for Czech, Slovak and Hungarian power. The subject of trading at the PXE is electricity with an hourly output of 1 MW for each hour of each day of the agreed delivery period. The delivery locations are the electricity systems in the Czech Republic, Slovakia and Hungary, the transport of electricity is not included in the contract price. The exchange offers anonymous trading with standardized products with secured settlement. In this market, yet there are three areas: Slovak Republic, Czech Republic and Hungary. However, soon other areas will be joined. The trading methods on this market are [6]:
1.   Trades concluded in the PXE system
2.   Trades concluded outside the PXE system
3.   Auction of hours outside the PXE trading system
These methods of trade are described in more detail in Fig. 1-3.
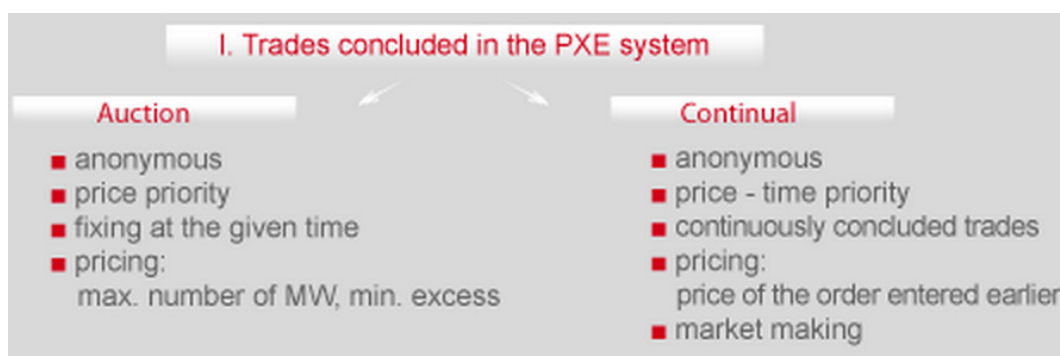

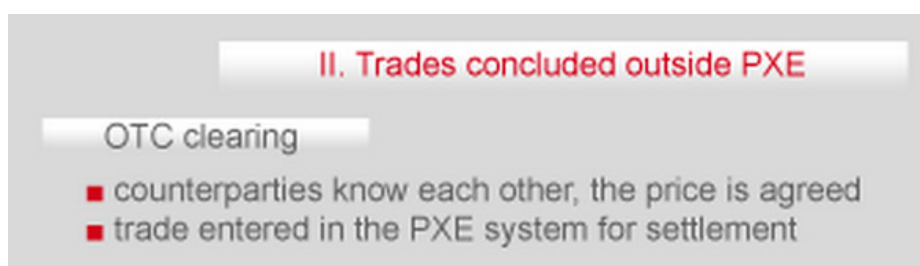
Figure 1 - Trades concluded in the PXE system [6]

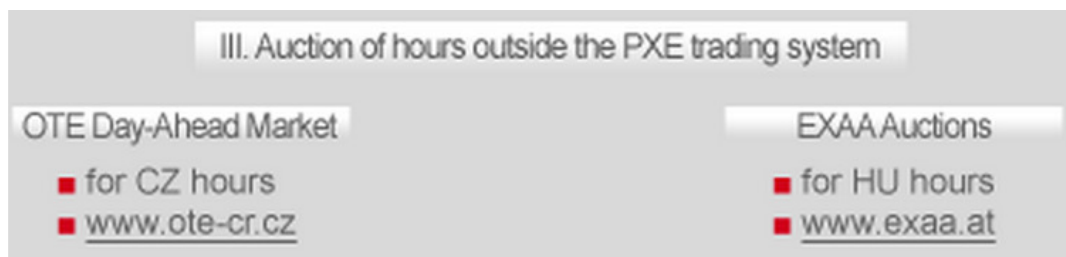Figure 2 – Trades concluded outside PXE [6]

Figure 3 – Auction of hours outside the PXE trading [6]

4. PREDICTION OF PRICE OF ELECTRICITY

Exchanges can be formed from different countries on the basis of respecting municipal legislation. An example of the exchange, which focuses on energy (electricity and gas), is CR exchange Power Exchange Central Europe (PXE). PXE was created on the basis of [6]. This auction method of marketing is based on the electronic processing of orders and instructions, and trades are concluded on the basis of the trading system. Calculation and determination of the course take place on the basis of the algorithm defined in the trading system [7-8].

For all commodities it is true that the trader is an advantage if you can predict the price of commodities with some accuracy. The same is true for electricity. Trader who can predict the future price of electricity is a significant advantage over other traders. This article is focused on a model prediction electricity using RSI model. RSI model will be described in the next chapter of this paper [9-10].

The pricing system of electricity is complicated and is the subject of various debates. It is this reason why electricity is a specific form of commodity in comparison with other commonly traded commodities at exchanges. Its significant disadvantage is that it is unstorable. Therefore, the concept of spot price was introduced. The term spot price is the price at a given point of supply for each time point. It is the spot price which affects the behaviour of traders.

Spot price can be broadly defined according to [2] as:

$$P = \frac{N_C}{S_C} \tag{1}$$

where P is the spot price, NC is the total cost of production and SC is the amount of electricity delivered if that is true:

$$\sum_{j=1}^{J} P_j(t) = \sum_{j=1}^{J} D_j(t) + L(t) \tag{2}$$

where $Pj(t)$ is the power of j-th source at node power system at time t, $Dj(t)$ is the consumption of j-th customer in node power system at time t, $L(t)$ are the losses in the power system.

Fig.4 shows the development of electricity price for the period from 4.1.2010 to 21.3.2014 traded on PXE exchange.

EMA exponential Moving Average is a trend following indicator. EMA is used in technical analysis to show the trend of a stock or future or whatever the underlying security. Exponential Moving Average shows the average value of the underlying data, most often the price of a security, for a given time period, attributing more weight to the latest changes and less to the changes that lie further away. Exponential Moving average is together with its simple counterpart (MA) considered to be one of the most common Indicators in nearly any technical analysis software available in the market today. It's a trend following indicator and is calculated like so [11-13]:

$$EMA = PRICE(t) * k + EMA(y) * (k - 1) \tag{8}$$

where t is today, y is yesterday, N is number of days in EMA and k is given:

$$k = \frac{2}{N+1} \tag{9}$$

Indicator MACD (Moving Average Convergence/Divergence) is one of the simplest and most reliable indicators available. MACD uses moving averages, which are lagging indicators, to include some trend-following characteristics. These lagging indicators are turned into a momentum oscillator

by subtracting the longer moving average from the shorter moving average. The resulting plot forms a line that oscillates above and below zero, without any upper or lower limits. MACD is a centered oscillator and the guidelines for using centered oscillator apply. The MACD indicator measures the difference between two moving averages (EMA) and is depicted as a line. The usual representation of the MACD indicator has another line – a short 9-day EMA of MACD – plotted together with the MACD in the chart, to act as a trigger indicator. MACD indicator crossed zero line, this is entry to position. If MACD indicator crossed zero line to up, this is entry to bought position. If MACD indicator crossed zero line to down, this is entry position to sell [12].
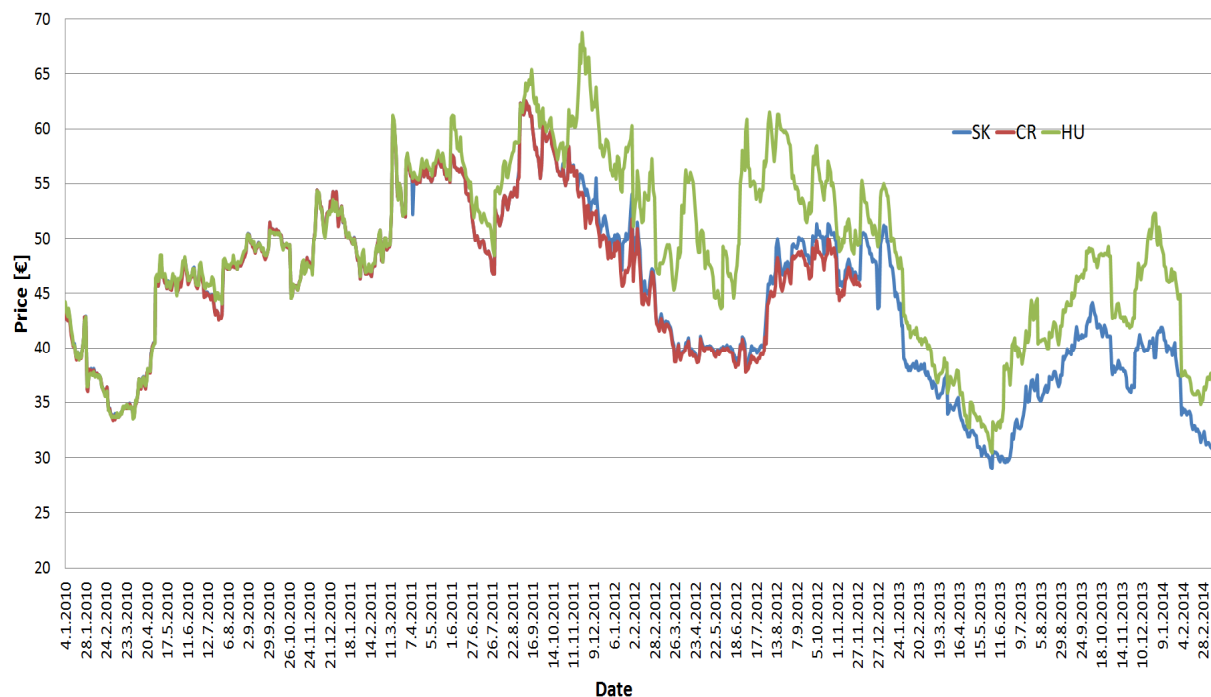

Figure 4 – Development of electricity price for the period from 4.1.2010 to 21.3.2014 traded on PXE exchange

5.   RESULTS

The Table 1 and Fig.5 shows all transactions for that period. Only three entries were predicted incorrectly and thus the overall prediction percentage is 77 percent. Overall, 43,15 euros were traded by using MACD mechanism.

The Table 2 and Fig.6 shows all transactions for that period. Only one entry was predicted incorrectly and thus the overall prediction percentage is 86 percent. Overall, 28,25 euros were traded by using MACD mechanism. If one contract is 1 MWh and consumption of electricity on Slovak republic area is 28TWh, it can be assumed that 1,208 billion euros were traded only on SK market.

Table 1 – Results of the trading on SK market

Poradie	Vstup [€]	Výstup [€]	Cenový rozdiel [€]
1	37.15	45.1	7.95
2	47.75	49.15	1.4
3	49.8	50.15	0.35
4	49.8	55.45	5.65
5	51.65	55.5	3.85
6	57	54	3
7	47.7	40	7.7
8	40.15	46.75	6.6
9	50.35	47.5	-2.85
10	50.3	47.3	-3
11	31.5	38.1	6.6
12	40.4	39.35	-1.05
13	39.15	32.2	6.95
SPOLU			
10			43.15

Table 2 – Results of the trading on CZ market

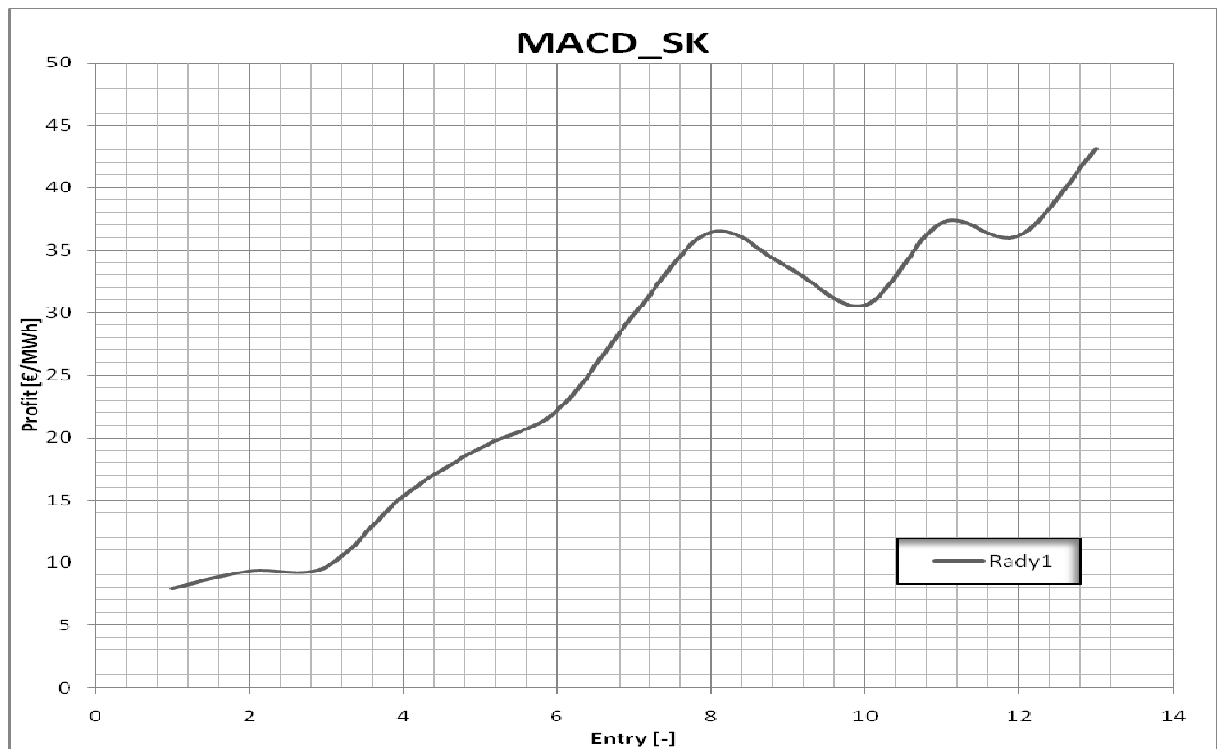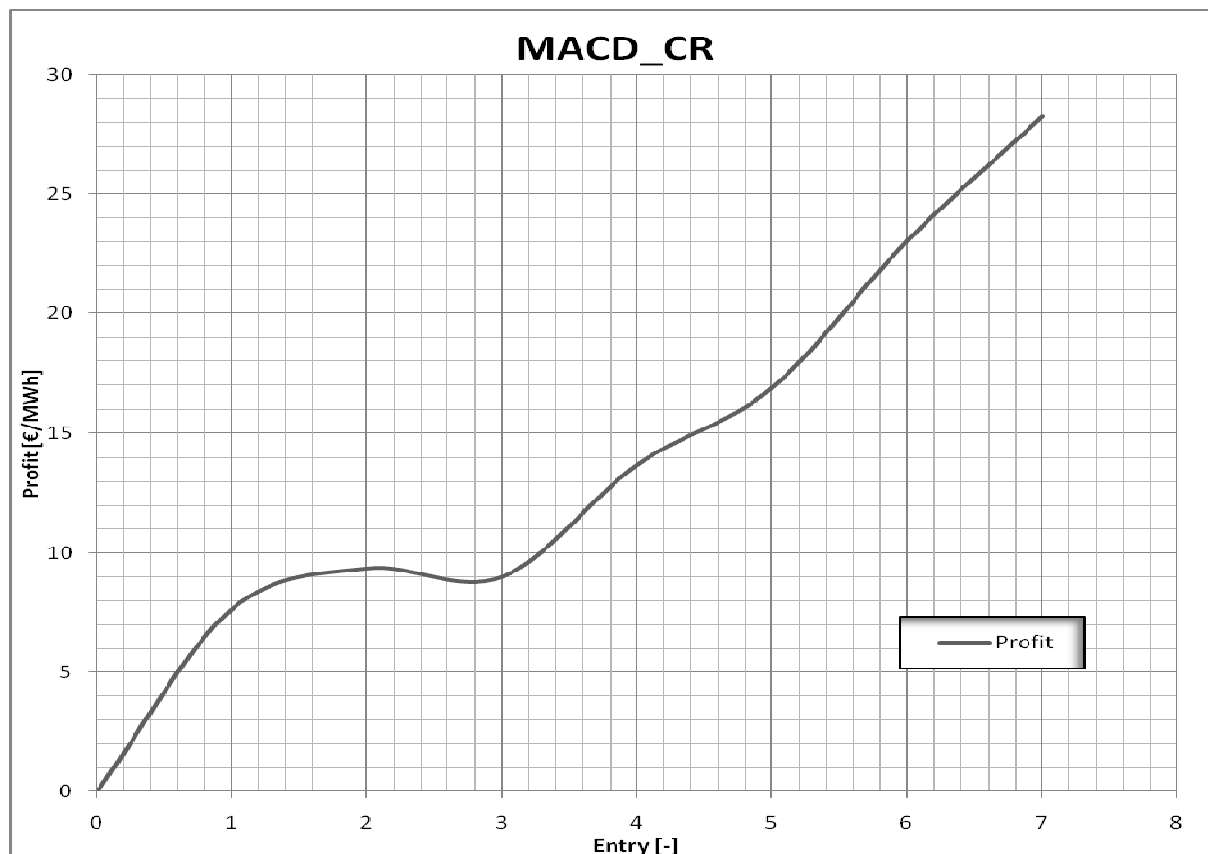| Poradie	Vstup [€]	Výstup [€]	Cenový rozdiel [€]
1	37.1	44.75	7.65
2	47.75	49.45	1.7
3	49.8	50.15	-0.35
4	50.75	55.45	4.7
5	52.3	55.5	3.2
6	57	50.85	6.15
7	39.85	45.05	5.2
SPOLU			
10			28.25

Figure 5 – Profit of MACD analysis on SK market

Figure 6 – Profit of MACD analysis on CZ market

6. CONCLUSIONS

This article discusses the mechanism of MACD. MACD prediction mechanism predicts the price trend of electricity on the basis of the indicator MACD. This way it is possible to predict the price of electricity. MACD mechanism works well during connection new sources of biomass too. Connecting new sources of biomass does not affect the MACD analysis of electricity prices.

MACD mechanism described in this article shows the prediction of 13 inputs on SK market and 7 inputs on CZ market. The system has higher frequency inputs by the combination of several mechanisms. The overall prediction percentage is 77 percent on SK market and 86 percent on CZ market, however, it should be noted that the number of inputs was not numerous.

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