VARIATION OF ENERGY PRICE AND PRICE COMPONENTS IN ROMANIAN ENERGY MARKET

Andreea BÎRLOG[1], Gheorghe LĂZĂROIU[2]

The energy market in Romania is very dynamic, the number of energy suppliers and producers, especially the renewable energy producers, has rapidly increased. This paper investigates and analyzes the components and variation of energy price at the end-user for a period of 6 years. The variations of the price components were investigated, and the importance of green certificates component in the final electricity price is highlighted. These prices can be used to foresee the electricity market evolution.

Keywords: energy price, energy market, regulated tariff.

1. Introduction

The final electricity price that a Romanian consumer had to pay for the past six years known a lot of variations. In Romania, the electricity price contains the price set by the energy supplier, the transmission and distribution tariffs settled by the Romanian Regulatory Authority for Energy, being added a contribution for high efficiency cogeneration, the cost of green certificates, the excise, and value-added tax (VAT). For the final consumer, it is important to understand these variations in order to predict his future costs. The present paper analyzes the fluctuations of the electricity price and of its components in the period 2010 to 2015.

The producers, the transmission operator and distribution have to become energy efficient and to reduce pollutant emissions, for this they have to introduce new and more performing technologies leading to big investments. Also, a lot of new producers from renewable sources are emerging. But these new technology costs are reduced by using European Funds and by Government policies. The major investments in production facilities were made years ago, and payed off. So, the technical factor implies less change in price formation.

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[1] Eng., Faculty of Power Engineering, University POLITEHNICA of Bucharest, Romania, e-mail: andreea.birlog@gmail.com

[2] Prof., Faculty of Power Engineering, University POLITEHNICA of Bucharest, Romania, e-mail: gheorghelazaroiu@yahoo.com

2. Variation of energy price and price components

The participants to the Romanian electricity markets are: the producers, the transmission Operator (Transelectrica SA), the energy distribution operators, the suppliers, and the consumers. The energy distribution network is divided in eight companies that have taken in concession parts of the grid previously administrated by the Romanian state.

The regulated transmission and distribution tariffs are as follows: T_{SS} – tariff for the system services; T_{OP} – tariff for the services provided by the electricity market operator to the participants at the energy market; T_G – medium tariff for the energy insertion in the national transmission grid; T_l – extraction tariff imposed on the energy extracted from the transmission grid; T_D – distribution tariff.

The distribution tariff is paid according to the voltage level supplied to the consumer. The Regulatory Authority for Energy establishes a high voltage tariff, a medium voltage tariff and a low voltage tariff, the low voltage tariff discussed in this paper is the sum of all three distribution tariffs. This means that the low voltage consumer has to pay for the conversion from high voltage to medium voltage, for the distribution of medium voltage, for the conversion from medium voltage to low voltage and also for the distribution of low voltage energy. Also, T_D varies with the distribution operator.

The analysis of these tariffs for the period 2010-2015 is reported in Tables 1-13. The analyzed suppliers (DO) are: 1. E.ON Moldova Distribuție SA, 2. FDEE Electrica Distribuție Muntenia Nord SA, 3. Enel Distribuție Dobrogea SA, 4. Enel Distribuție Muntenia SA, 5. CEZ Distribuție SA, 6. Enel Distribuție Banat SA, 7. FDEE Electrica Distribuție Transilvania Nord SA, 8. FDEE Electrica Distribuție Transilvania Sud SA [1].

The excise that a consumer must pay is 0.5 Euro/MWh or 1 Euro/MWh, depending on the energy usage. For private use, the excise is 1 Euro/MWh, for commercial use the excise is 0.5 Euro/MWh. In this paper the considered excise is 0.5 Euro/MWh. The excise equivalent in RON obtained until 31.12.2014, according to [2], is based on the exchange rate RON – euro established on the 1st of October of the previous year and published in the Official Journal of the European Union. Starting with 01.01.2015, according to [3], the excises are annually indexed with de growth of consumption prices of the last 12 months, so the exchange rate is calculated in September for the next year, based on the period between October 2013 – September 2014. The excise is officially communicated by the National Statistics Institute until the 15 October of each year. The indexed level of the excises is published on the Ministry of Public Finance website until 20 of October at the latest, each year.

This paper investigates also the variation of the supply price (P_s), which is the price at which the energy retailer sells to the end user. The data reported in Tables 1–13 uses the average MWh price on the wholesale market, and in particular on the centralized

market for bilateral contracts, published regularly [1]. For 2015, the mean average of the monthly weighted average prices was used, published by OPCOM [4], and reported in Table 14. The last column in Tables 1-13 reports the total price T_p, VAT included, paid by the final consumer. All other tariffs do not include VAT.

Table 1

Price and tariff variation during 01.01.2010 – 30.06.2010 [RON/MWh]

DO	T_{SS}	T_{OP}	T_G	T_l	T_D	Excise	P_S	T_p
1.	20.68	0.30	8.41	8.50	188.17	2.1344	157.01	458.39
2.	20.68	0.30	8.41	12.01	169.15	2.1344	157.01	439.94
3.	20.68	0.30	8.41	9.03	186.72	2.1344	157.01	457.30
4.	20.68	0.30	8.41	7.41	163.25	2.1344	157.01	427.44
5.	20.68	0.30	8.41	6.63	202.00	2.1344	157.01	472.63
6.	20.68	0.30	8.41	8.57	189.28	2.1344	157.01	459.80
7.	20.68	0.30	8.41	8.55	149.06	2.1344	157.01	411.91
8.	20.68	0.30	8.41	10.19	179.55	2.1344	157.01	450.15
Mean	**20.68**	**0.30**	**8.41**	**8.86**	**178.40**	**2.13**	**157.01**	**447.20**

Table 2

Price and tariff variation during 01.07.2010 – 31.12.2010 [RON/MWh]

DO	T_{SS}	T_{OP}	T_G	T_l	T_D	Excise	P_S	T_p
1.	20.68	0.30	8.41	8.50	188.17	2.1344	157.01	477.65
2.	20.68	0.30	8.41	12.01	169.15	2.1344	157.01	458.42
3.	20.68	0.30	8.41	9.03	186.72	2.1344	157.01	476.51
4.	20.68	0.30	8.41	7.41	163.25	2.1344	157.01	445.40
5.	20.68	0.30	8.41	6.63	202.00	2.1344	157.01	492.48
6.	20.68	0.30	8.41	8.57	189.28	2.1344	157.01	479.12
7.	20.68	0.30	8.41	8.55	149.06	2.1344	157.01	429.22
8.	20.68	0.30	8.41	10.19	179.55	2.1344	157.01	469.06
Mean	**20.68**	**0.30**	**8.41**	**8.86**	**178.40**	**2.13**	**157.01**	**465.98**

Table 3

Price and tariff variation during 01.01.2011 – 31.03.2011 [RON/MWh]

DO	T_{SS}	T_{OP}	T_G	T_l	T_D	Excise	P_S	T_p
1.	20.75	0.30	8.60	11.60	196.15	2.1328	171.78	510.03
2.	20.75	0.30	8.60	11.87	190.07	2.1328	171.78	502.82
3.	20.75	0.30	8.60	8.73	186.72	2.1328	171.78	494.78
4.	20.75	0.30	8.60	11.11	151.21	2.1328	171.78	453.69
5.	20.75	0.30	8.60	8.14	202.00	2.1328	171.78	512.99
6.	20.75	0.30	8.60	10.55	192.66	2.1328	171.78	504.40
7.	20.75	0.30	8.60	11.13	151.60	2.1328	171.78	454.20
8.	20.75	0.30	8.60	11.08	174.30	2.1328	171.78	482.29
Mean	**20.75**	**0.30**	**8.60**	**10.53**	**180.59**	**2.13**	**171.78**	**489.40**

Tables 1–13 reports the variation of T_p according to the distribution area,

changes in regulated tariffs or legal modifications. The difference between Table 1 and Table 2 is the VAT quota, that changed starting with 01.07.2010 from 19% to 24%.

Table 4

Price and tariff variation during 01.04.2011 – 31.12.2011 [RON/MWh]

DO	T_{SS}	T_{OP}	T_G	T_l	T_D	Excise	CC	P_S	T_p
1.	10.21	0.30	8.60	11.60	196.15	2.1328	18.50	171.78	519.90
2.	10.21	0.30	8.60	11.87	190.07	2.1328	18.50	171.78	512.69
3.	10.21	0.30	8.60	8.73	186.72	2.1328	18.50	171.78	504.65
4.	10.21	0.30	8.60	11.11	151.21	2.1328	18.50	171.78	463.57
5.	10.21	0.30	8.60	8.14	202.00	2.1328	18.50	171.78	522.86
6.	10.21	0.30	8.60	10.55	192.66	2.1328	18.50	171.78	514.27
7.	10.21	0.30	8.60	11.13	151.60	2.1328	18.50	171.78	464.07
8.	10.21	0.30	8.60	11.08	174.30	2.1328	18.50	171.78	492.16
Mean	**10.21**	**0.30**	**8.60**	**10.53**	**180.59**	**2.13**	**18.50**	**171.78**	**499.27**

Table 5

Price and tariff variation during 01.01.2012 – 30.06.2012 [RON/MWh]

DO	T_{SS}	T_{OP}	T_G	T_l	T_D	Excise	GC	CC	P_S	T_p
1.	10.21	0.30	8.60	11.60	196.15	2.1501	29.30	18.50	215.25	610.16
2.	10.21	0.30	8.60	11.87	190.07	2.1501	29.30	18.50	215.25	602.96
3.	10.21	0.30	8.60	8.73	186.72	2.1501	29.30	18.50	215.25	594.91
4.	10.21	0.30	8.60	11.11	151.21	2.1501	29.30	18.50	215.25	553.83
5.	10.21	0.30	8.60	8.14	202.00	2.1501	29.30	18.50	215.25	613.12
6.	10.21	0.30	8.60	10.55	192.66	2.1501	29.30	18.50	215.25	604.53
7.	10.21	0.30	8.60	11.13	151.60	2.1501	29.30	18.50	215.25	554.34
8.	10.21	0.30	8.60	11.08	174.30	2.1501	29.30	18.50	215.25	582.42
Mean	**10.21**	**0.30**	**8.60**	**10.53**	**180.59**	**2.15**	**29.30**	**18.50**	**215.25**	**589.53**

Table 6

Price and tariff variation during 01.07.2012 – 31.12.2012 [RON/MWh]

DO	T_{SS}	T_{OP}	T_G	T_l	T_D	Excise	GC	CC	P_S	T_p
1.	10.21	0.30	8.60	11.60	202.00	2.1501	28.81	21.20	215.25	620.14
2.	10.21	0.30	8.60	11.87	199.00	2.1501	28.81	21.20	215.25	616.76
3.	10.21	0.30	8.60	8.73	202.00	2.1501	28.81	21.20	215.25	616.58
4.	10.21	0.30	8.60	11.11	177.92	2.1501	28.81	21.20	215.25	589.68
5.	10.21	0.30	8.60	8.14	202.00	2.1501	28.81	21.20	215.25	615.85
6.	10.21	0.30	8.60	10.55	202.00	2.1501	28.81	21.20	215.25	618.84
7.	10.21	0.30	8.60	11.13	164.42	2.1501	28.81	21.20	215.25	572.96
8.	10.21	0.30	8.60	11.08	186.25	2.1501	28.81	21.20	215.25	599.97
Mean	**10.21**	**0.30**	**8.60**	**10.53**	**191.95**	**2.15**	**28.81**	**21.20**	**215.25**	**606.35**

Starting with 01.04.2011, the contribution for High Efficiency Cogeneration (CC) tariff is introduced. This is a monthly amount that each

consumer has to pay in order to support the development of cogeneration production at higher standards, to increase energy efficiency and the reliability of the power system.

According to [5] and [6], starting with 2012, the green gertificates (GC) are introduced with the purpose of incentivizing the renewable energy producers.

Table 7

Price and tariff variation during 01.01.2013 – 02.08.2013 [RON/MWh]

DO	T_{SS}	T_{OP}	T_G	T_l	T_D	Excise	GC	CC	P_S	T_p
1.	10.91	0.37	9.70	13.05	212.30	2.2612	44.17	23.10	204.47	645.21
2.	10.91	0.37	9.70	13.36	212.30	2.2612	44.17	23.10	204.47	645.59
3.	10.91	0.37	9.70	9.82	212.30	2.2612	44.17	23.10	204.47	641.20
4.	10.91	0.37	9.70	12.50	186.99	2.2612	44.17	23.10	204.47	613.14
5.	10.91	0.37	9.70	9.16	212.30	2.2612	44.17	23.10	204.47	640.38
6.	10.91	0.37	9.70	11.87	212.30	2.2612	44.17	23.10	204.47	643.74
7.	10.91	0.37	9.70	12.52	172.80	2.2612	44.17	23.10	204.47	595.57
8.	10.91	0.37	9.70	12.47	195.75	2.2612	44.17	23.10	204.47	623.97
Mean	**10.91**	**0.37**	**9.70**	**11.84**	**202.13**	**2.26**	**44.17**	**23.10**	**204.47**	**631.10**

Table 8

Price and tariff variation during 03.08.2013 – 31.12.2013 [RON/MWh]

DO	T_{SS}	T_{OP}	T_G	T_l	T_D	Excise	GC	CC	P_S	T_p
1.	13.42	0.37	9.70	13.05	212.30	2.2612	41.90	23.10	204.47	645.51
2.	13.42	0.37	9.70	13.36	212.30	2.2612	41.90	23.10	204.47	645.90
3.	13.42	0.37	9.70	9.82	212.30	2.2612	41.90	23.10	204.47	641.51
4.	13.42	0.37	9.70	12.50	186.99	2.2612	41.90	23.10	204.47	613.45
5.	13.42	0.37	9.70	9.16	212.30	2.2612	41.90	23.10	204.47	640.69
6.	13.42	0.37	9.70	11.87	212.30	2.2612	41.90	23.10	204.47	644.05
7.	13.42	0.37	9.70	12.52	172.80	2.2612	41.90	23.10	204.47	595.87
8.	13.42	0.37	9.70	12.47	195.75	2.2612	41.90	23.10	204.47	624.27
Mean	**13.42**	**0.37**	**9.70**	**11.84**	**202.13**	**2.26**	**41.90**	**23.10**	**204.47**	**631.41**

Table 9

Price and tariff variation during 01.01.2014 – 28.02.2014 [RON/MWh]

DO	T_{SS}	T_G	T_l	T_D	Excise	GC	CC	P_S	T_p
1.	15.02	10.16	13.52	214.50	2.3690	37.47	18.38	173.90	601.79
2.	15.02	10.16	13.84	206.05	2.3690	37.47	18.38	173.90	591.71
3.	15.02	10.16	10.17	211.67	2.3690	37.47	18.38	173.90	594.13
4.	15.02	10.16	12.95	182.47	2.3690	37.47	18.38	173.90	561.37
5.	15.02	10.16	9.49	210.78	2.3690	37.47	18.38	173.90	592.18
6.	15.02	10.16	12.30	175.63	2.3690	37.47	18.38	173.90	552.08
7.	15.02	10.16	12.97	178.75	2.3690	37.47	18.38	173.90	556.78
8.	15.02	10.16	12.92	194.74	2.3690	37.47	18.38	173.90	576.54
Mean	**15.02**	**10.16**	**12.27**	**196.82**	**2.37**	**37.47**	**18.38**	**173.90**	**578.32**

The green energy producers receive for 1 MWh provided to the electrical grid a regulated number of green certificate that can be traded on the green certificates Market. The energy suppliers have to buy a number of green certificate corresponding to a mandatory annual quota calculated and imposed by the Regulatory Authority for Energy.

Table 10

Price and tariff variation during 01.03.2014 – 30.06.2014 [RON/MWh]

DO	T_{SS}	T_G	T_l	T	Excise	GC	CC	P_S	T_p
1.	15.02	10.16	13.52	214.50	2.3690	29.02	18.38	173.90	591.32
2.	15.02	10.16	13.84	206.05	2.3690	29.02	18.38	173.90	581.24
3.	15.02	10.16	10.17	211.67	2.3690	29.02	18.38	173.90	583.66
4.	15.02	10.16	12.95	182.47	2.3690	29.02	18.38	173.90	550.90
5.	15.02	10.16	9.49	210.78	2.3690	29.02	18.38	173.90	581.71
6.	15.02	10.16	12.30	175.63	2.3690	29.02	18.38	173.90	541.61
7.	15.02	10.16	12.97	178.75	2.3690	29.02	18.38	173.90	546.31
8.	15.02	10.16	12.92	194.74	2.3690	29.02	18.38	173.90	566.07
Mean	**15.02**	**10.16**	**12.27**	**196.82**	**2.37**	**29.02**	**18.38**	**173.90**	**567.85**

Table 11

Price and tariff variation during 01.07.2014 – 31.12.2014 [RON/MWh]

DO	T_{SS}	T_G	T_l	T_D	Excise	GC	CC	P_S	T_p
1.	13.96	10.30	13.76	214.50	2.3690	28.49	9.96	173.90	579.38
2.	13.96	10.30	14.05	206.05	2.3690	28.49	9.96	173.90	569.26
3.	13.96	10.30	10.30	211.67	2.3690	28.49	9.96	173.90	571.58
4.	13.96	10.30	13.14	182.47	2.3690	28.49	9.96	173.90	538.89
5.	13.96	10.30	9.63	210.78	2.3690	28.49	9.96	173.90	569.64
6.	13.96	10.30	12.52	175.63	2.3690	28.49	9.96	173.90	529.64
7.	13.96	10.30	13.20	178.75	2.3690	28.49	9.96	173.90	534.35
8.	13.96	10.30	13.15	194.74	2.3690	28.49	9.96	173.90	554.12
Mean	**13.96**	**10.30**	**12.47**	**196.82**	**2.37**	**28.49**	**9.96**	**173.90**	**555.86**

Table 12

Price and tariff variation during 01.01.2015 – 30.06.2015 [RON/MWh]

DO	T_{SS}	T_G	T_l	T_D	Excise	GC	CC	P_S	T_p
1.	13.96	10.30	13.76	208.84	2.3690	36.41	18.12	158.71	573.46
2.	13.96	10.30	14.05	199.92	2.3690	36.41	18.12	158.71	562.75
3.	13.96	10.30	10.30	211.33	2.3690	36.41	18.12	158.71	572.25
4.	13.96	10.30	13.14	183.53	2.3690	36.41	18.12	158.71	541.30
5.	13.96	10.30	9.63	211.11	2.3690	36.41	18.12	158.71	571.15
6.	13.96	10.30	12.52	200.54	2.3690	36.41	18.12	158.71	561.63
7.	13.96	10.30	13.20	180.59	2.3690	36.41	18.12	158.71	537.73
8.	13.96	10.30	13.15	192.65	2.3690	36.41	18.12	158.71	552.62
Mean	**13.96**	**10.30**	**12.47**	**198.56**	**2.37**	**36.41**	**18.12**	**158.71**	**559.11**

During 01.01.2012 - 28.02.2014, the green certificate price is calculated as the product of this quota (reported in Table 15) and the weighted average price of the green certificates on the centralized green certificates market (Table 16). Starting with 01.01.2014 T_{OP} – services tariffs imposed by the administrator of the centralized market on the participants at the energy market are removed.

Table 13

Price and tariff variation during 01.07.2015 – 31.12.2015 [RON/MWh]

DO	T_{SS}	T_G	T_l	T_D	Excise	GC	CC	P_S	T_p
1.	13.75	2.57	19.49	208.84	2.3690	36.44	15.82	167.91	579.32
2.	13.75	2.57	19.19	199.92	2.3690	36.44	15.82	167.91	567.88
3.	13.75	2.57	16.17	211.33	2.3690	36.44	15.82	167.91	578.29
4.	13.75	2.57	18.53	183.53	2.3690	36.44	15.82	167.91	546.74
5.	13.75	2.57	15.26	211.11	2.3690	36.44	15.82	167.91	576.89
6.	13.75	2.57	19.15	200.54	2.3690	36.44	15.82	167.91	568.60
7.	13.75	2.57	19.57	180.59	2.3690	36.44	15.82	167.91	544.39
8.	13.75	2.57	19.37	192.65	2.3690	36.44	15.82	167.91	559.09
Mean	**13.75**	**2.57**	**18.34**	**198.56**	**2.37**	**36.44**	**15.82**	**167.91**	**565.15**

After 01.03.2014, the price of green certificate is obtained from the product of the mandatory quota and of price paid by the supplier for the green certificate. In the present paper, the supplier price is estimated using the mean price at which the green certificates were traded on green certificates market during a certain period (Table 17). The green certificate price paid between 01.01 – 02.08.2013 had the biggest value recorded in the studied period, caused by the rise of the mandatory quota and due to the price increase of green certificate traded on the green certificates market. The change in the way the green certificate price is calculated has led to a significant decrease of its final value.

Fig. 1 illustrates the statistical analysis of Tp evolution during the 6 years analysis period for the 8 distribution operators. The boxplots illustrate the minimum and maximum values for each series of Tp values and for each DO. In addition, the first (25%) and third quartile (75%) are represented. The mean and median value of the electricity price are shown.

A forecasting function of the electricity prices is difficult to be obtained as the historical values are highly influenced by the governmental incentives for cogeneration efficiency and green certificates. The total energy price is obtained as follows:

$$T_P = T_{ss} + T_{OP} + T_G + T_l + T_D + Excise + GC + CC + P_s + VAT \cdot (T_{ss} + T_{OP} + T_G + T_l + T_D + Excise + GC + CC + P_s) \qquad (1)$$
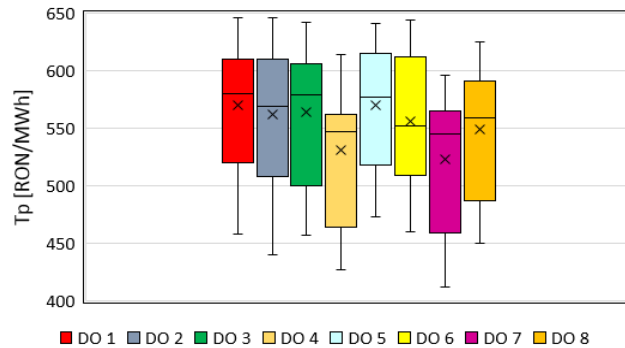
Fig. 1. Statistical analysis of Tp variation for the 8 DOs during the 6 years analyzed period

As mentioned before some of the total price components derive from the following data sets (Tables 14–17): the mean prices for base energy in 2015, the mandatory quota for the green certificate, the weighted average price of the green certificate until 28.02.2014 and the mean green certificate price traded on OPCOM after 01.03.2014.

Table 14

2015 weighted average price of electricity traded on the energy market [4]

Month	Weighted average price [RON/MWh]
January	183.30*
February	183.30
March	155.92
April	155.55
May	154.94
June	154.61
July	158.98
August	159.35
September	159.57
October	162.61
November	163.74
December	164.22

*For January the price hasn't been published so we used the February price

Table 15

The annual GC mandatory quota [1]

Year	GC quota
2012	0.1188
2013	0.224
2014	0.218
2015	0.278

The weighted average price is the estimate price of green certificate in previous year for the current year on the centralized market of green certificates, considering the ratio between the demand and offer of green certificates estimated for the current year. According to the Methodology for establishing the mandatory annual quota of electrical energy produced from renewable sources that benefits of the promotion through green certificate published by [1, 7], the green certificate paid by the consumer in the current year is an estimated value based on an estimated green certificate quota, the next year final green certificate quota is established and the sum paid is then regularized. The estimated quota ($c_{GCestimated,t}$) is calculated in year $t-1$ for year t as [7]:

$$NGC_{emited,t} = \sum_{j}^{n} NGC_j * ESRE_{j,t} \tag{2}$$

where $NGC_{emited,t}$ – the number of green certificates that will be emitted in year t; NGC_j – the green certificates number emitted for 1 MWh supplied to the grid, differentiated by renewable energy source type j; $ESRE_{j,t}$ – the renewable source energy estimated to be produced in next year t, by renewable energy source type j.

$$c_{GCestimated,t} = \frac{NGC_{emited,t}}{CFEE_{estimated t}} \tag{3}$$

where $CFEE_{estimated}$ – final electrical energy consumption estimated for year t.

The final GC quota ($c_{GC,t}$) for year t is calculated in the next year as:

$$c_{GC,t} = \frac{NGC_t}{CFEE_t} \tag{4}$$

where NGC_t – the number of GC emited for trading by System and Transmission Operator in year t; $CFEE_t$ – final electrical energy consumption for year t.

The energy produced from renewable sources in year t has to be smaller than the maximum level of energy produced from renewables that benefit of green certificates. So, the energy produced and supplied to the consumers in year t, $ESRE_t$, is compared to the energy produced from renewables that is supported through green certificates, $ESRE_{t,CAP.}$

$$ESRE_{t,CAP} = \frac{I_{CV,t} \times CFEE_t}{\frac{NGC_t}{ESRE_t} \times p_{GC,t}} \tag{5}$$

where $I_{Cv,t}$ – the GC impact in the final consumer's costs; $p_{GC,t}$ – mean price for the green certificates on the green certificates centralized market.

If $ESRE_t \leq ESRE_{t,CAP}$, the green certificates quota is calculated with expression (4), if $ESRE_t \geq ESRE_t$, the green certificates quota ($c^1_{GC,t}$) is calculated as:

$$R_t = \frac{ESRE_{t,CAP}}{ESRE_t} \tag{6}$$

NGC_t in (4) will be replaced by:

$$NGC_t^1 = R_t \times NGC_t \qquad\qquad (7)$$

$$c_{Gc,t}^1 = \frac{NGC_t^1}{CFEE_t} \text{ [GC/MWh]} \qquad\qquad (8)$$

Table 16

Weighted average price for the GC

Period	Weighted average price [RON/GC]
January – June 2012	246.67
July – August 2012	240.86
September– November 2012	243.27
December 2012 – February 2013	241.49
March – May 2013	180.22
June – August 2013	178.29
September – November 2013	186.96
December 2013 – February 2014	196.16

Table 17

Mean GC price traded on the Centralized GC Market

Month	GC price [RON/GC]
March 2014	140.46*
April 2014	130.69
May 2014	130.69
June 2014	130.69
July 2014	130.69
August 2014	130.69
September 2014	130.69
October 2014	130.69
November 2014	130.69
December 2014	130.69
January 2015	130.69
February 2015	130.69
March - December 2015	131.0847

*In march 2014 there were 3 trading sessions, we used the mean price

Fig. 2 shows the variation of the total price for the studied period. In Fig. 3, the variation of the total price for each Distribution Operator is illustrated.
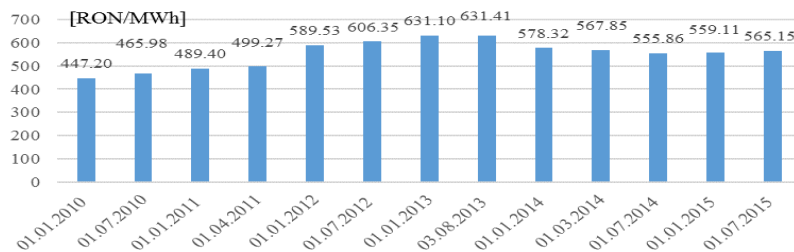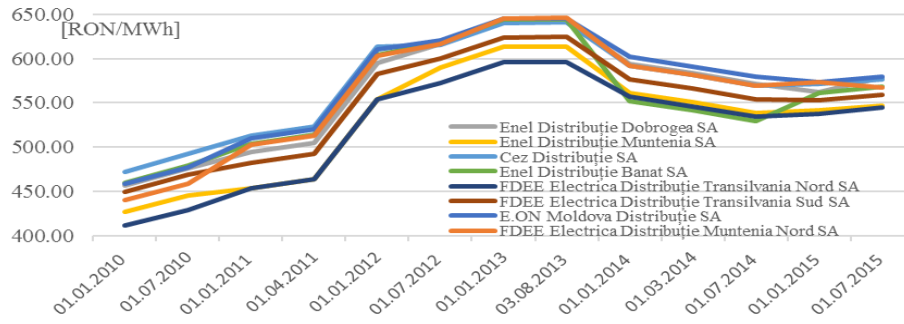

Fig. 2 Mean price evolution [RON/MWh]

Fig. 3 Price evolution of each Distribution Operator during the studied period

3. Energy price forecast methods

There are many methods to forecast the energy price multi-agent models, fundamental methods, reduced-form approaches, statistical (econometric, technical analysis) methods, computational intelligence techniques or combination of these [8]. One of the most used method for energy price forecast is the regression model (statistical method) that describes the relation between energy prices and market characteristics [9]. The mathematical relationship between the different variables is given by the following relation [10]:

$$P_t = B_t X_t + \varepsilon_t = b_{1,t} X_t^{(1)} + \cdots + b_{k,t} X_t^{(k)} + \varepsilon_t \tag{9}$$

where: P_t – energy price; B_t – $1 \times k$ vector of coefficients that vary in time;
X_t – $k \times 1$ vector of regressors; k – number of data points analyzed;
ε_t – error term.

4. Conclusions

This paper deals with the analysis of the evolution of energy price, of each price component and determining price factors for a period of six years. The accent was put on the way the green certificates price was calculated because of the major impact had on the total price, and because is hard for the consumer to understand the composing mechanisms. From the analysis is concluded from that the main factor determining changes is the political one, the change of VAT, introduction of contribution for high efficiency cogeneration (CC) and of green certificates (GC) to support energy efficiency and renewable energy producers. The total energy price had a significant increase starting with 2012, the year the green certificates have been introduced. Also, the way the excise is calculated determines changes in energy price. From economical point of view, the biggest development was Romanian energy market liberalization, conferring consumers the right to choose their energy supplier and the possibility to negotiate price.

Distribution, transmission and system tariffs are regulated by ANRE and don't inflict major changes in price variation. In the end, the price formation mechanism is the demand and supply force, determined by the number of participants on the market (producers and buyers), the income of the buyers, expectation of price evolution, production costs and technology involved. The energy price had an interesting evolution for the past years. The consumer must be aware of its fluctuation and the mechanisms of the energy market in order to predict costs and be able to negotiate with the supplier. The current trend indicates a decrease, due to the fact that the number of the participants on the market has increased, suppliers have to buy green certificates on the liberalized market and use an average price no longer imposed by OPCOM. In addition, the decrease is due to the small consumers who used to pay a mandatory price regulated by the Regulatory Authority for Energy (ANRE) and now are beginning to negotiate directly with the suppliers.

R E F E R E N C E S

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