ANALYZING OF THE RECENT EVOLUTION OF THE ENERGY COMPETITIVENESS OF ROMANIA

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Abstract: The work represents a continuation of the author's concerns regarding sustainable development and energy competitiveness. Based on the data extracted from the official statistics, is highlighted the evolution over time - at the level of Romania - of nine fundamental indicators of energy competitiveness and four indicators aggregated on the essential directions of energy competitiveness: security, efficiency, environmental impact and the degree of valorisation of renewable energy resources. There is a significant increase in Romania's energy competitiveness during the analyzed period.

Keywords: energy, competitiveness, evolution, sustainable development

1.INTRODUCTION

Romania's integration into the EU has meant that our country is compatible with the policies and strategies established at EU level, from all points of view. The energy industry is one of those branches of industry that has met the demands of EU integration [1].

The present work is a continuation of the author's concerns regarding the energy competitiveness of Romania, treated in the wider context of sustainable development. In this context, Romania and the EU have set up strategies [2,3,4] with precise goals and targets on sustainable development, strategies that integrate and energy requirements - an essential area of any economy that has adopted the principles of sustainable development.

In [5,6] it was proposed the set of indicators that characterize the level of competitiveness of the energy industry of a country or a group of countries, as is the case of the EU, indicators structured on 5 pillars, as follows:
- Energy security (with 4 indicators)
- Energy efficiency (with 4 indicators)
- Environmental impact of energy processes (with 6 indicators)
- The degree of exploitation of renewable energy resources (with 9 indicators)
- Institutional capacity (with 15 indicators)

The characterization of Romania's level of energy competitiveness was made until 2010 [6, 7], only on the basis of 9 indicators, included in official statistics [8, 9], aggregated on the first four pillars. This paper aims to highlight the recent evolution, at the level of Romania, of the 9 fundamental indicators and of the aggregated indicators on the four pillars, as well as the opportunity to consider other fundamental indicators for characterizing the energy competitiveness.

2.METHODOLOGY OF WORK AND RESULTS

In order to highlight the evolution of Romania's energy competitiveness (CER) during the period [2010-2015] we will analyze the information existing in the official databases [8, 9] and we will use the following tools:
- The official representation of the evolution over time of the 9 fundamental indicators (IF) noted according to [5,6], as follows: {1.3, 1.12, 2.1, 2.4, 3.1, 3.2, 4.1, 4.2, 4.3}
- Evolution of the relative percentage value of each IF, in 2015, compared to the reference year (2010)
- Evaluation of aggregate indicators (IA) values in 2015, and their percentage values, compared to the reference year

The mathematical model is simple, including the following computational relations:
- The IF values from positions [4.1 ÷ 4.3] are calculated with the relation (5.1), and normate with the relation (5.5), reproduced in [6]. Relative percentage value of an IF:

$$IF_{ri} = \frac{IF_I(2015)}{IF_I(2010)} \ 100 \ [\%] \quad (1)$$

- The IA values for the 'j' pillar:

$$IA_J = \sum_{i=1}^{N} P_{ji} x IF_{ji} \quad j=\overline{1,4} \quad (2)$$

n = number of IFs in the 'j' pillar

P_{ji} = weight of the fundamental indicator 'i' in the pillar 'j'

IF_{ji} = value of IF ,, i " in the pillar 'j'

- Relative percentage value of an AI:

$$IA_{rj} = \frac{IA_J(2015)}{IA_J(2010)} 100 \ [\%] \quad (3)$$

The recent evolution of the nine indicators that characterize CER is shown in figures 1 ÷ 4
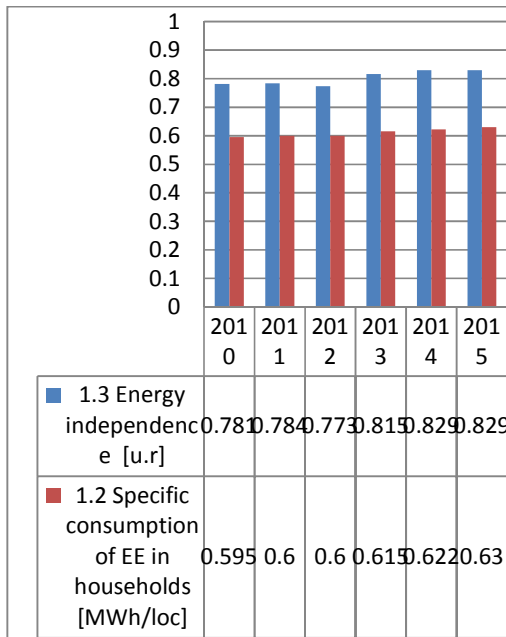
Fig 1 The recent evolution of the CER of CER from pillar 1

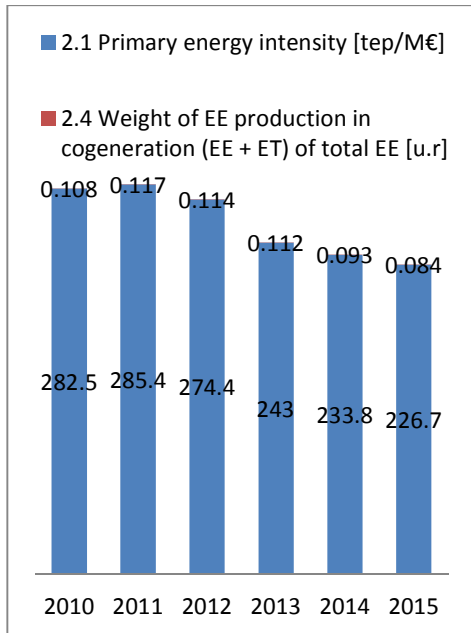Source: Created by the author based on data taken from [8, 9]

Fig. 2 The recent evolution of the IF of CER from pillar 2

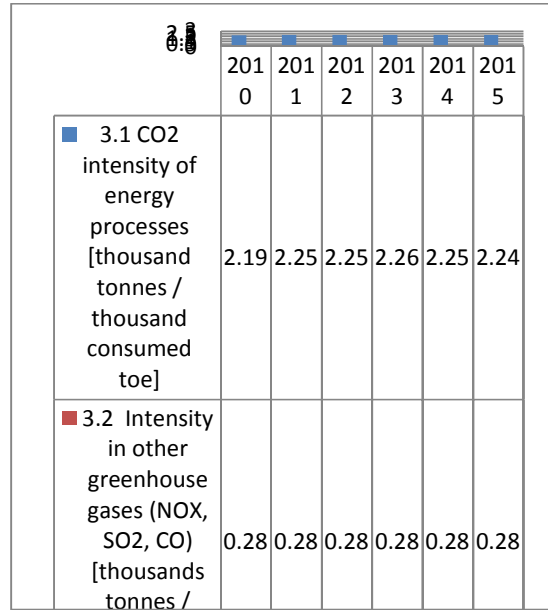Source: Created by the author based on data taken from [8, 9]

Fig. 3 The recent evolution of the CER of CER from pillar 3

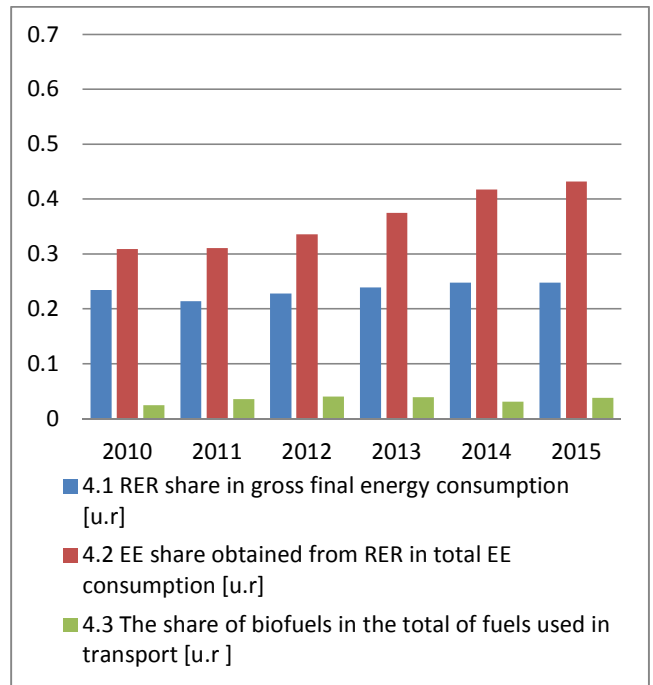Source: Created by the author based on data taken from [8, 9]

Fig. 4 The recent evolution of the CER of CER from pillar 4

Source: Created by the author based on data taken from [8, 9]

The relative percentage values of IF and AI are shown in Table 1.

Table 1 Relative percentage values of IF and IA [2015/2010]

The Pillar	The Indicator	P_{ji}	Relative percentage value [%]	
			IF_r	IA_r
1	1.3 Energy independence [u.r]	0,75	106,1	106,05
	1.2 Specific consumption of EE in households [MWh/loc]	0,25	105,9	
2	2.1 Primary energy intensity [tep/M€]	0,6	80,2	79,2
	2.4 Weight of EE production in cogeneration (EE + ET) of total EE [u.r]	0,4	77,8	
3	3.1 CO2 intensity of energy processes [thousand tonnes / thousand consumed toe]	0,5	102,3	101,1
	3.2 Intensity in other greenhouse gases (NOX, SO2, CO) [thousands tonnes / thousands consumed toe]	0,5	100	
4	4.1 RER share in gross final energy consumption [u.r]	0,4	106	131,8
	4.2 EE share obtained from RER in total EE consumption [u.r]	0,3	140	
	4.3 The share of biofuels in the total of fuels used in transport [u.r]	0,3	158	

Source: Created by the author based on data taken from [8, 9]

3. CONCLUSIONS

During the analyzed period, Romania's energy competitiveness has improved overall and with reference to most indicators. Energy security increased by about 6%, the components having a very close growth (6.1% and 5.9% respectively). On the whole, it can be stated that the energy efficiency has improved, the two components that can be highlighted had a decrease, with different significance, as follows:

• The decrease of the energy intensity by about 20% is essential for improving the energy efficiency of the economy as a whole;

• The decrease of the EE share produced in cogeneration by about 22% reflects the continuation - during this period - of the restructuring of the units producing (EE + ET), in the sense of removing from use and / or not using to the same extent as in the previous period, those groups with low energy efficiency, pollutants, against the backdrop of increasing the share of units that use renewable energy resources.

From the point of view of the indicators used, in Pillar 3, we find a slight degradation (1.1%) of the CER, on the level related to the environmental impact of the energy processes. It is a result due to the use of relative indicators [tonnes of GHG / tol energy consumed. However, the amount of GHGs from energy processes has decreased from 84.6 million tonnes CO2 equivalent (2010), to 80.1 million tonnes CO2 equivalent (2015), due to the more pronounced reduction of energy consumption [9] , the relative value of AI for pillar 3 increased.

The biggest increase in competitiveness (31.8%) is found with reference to pillar 4, from the point of view of all indicators, the weights being different as follows:

• The share of biofuels in the total fuel consumption used in transport had the highest increase (58%), although during the analysis period there are some fluctuations;

• The share of EE obtained from the RER decreased by 40%, and the share of these resources in the gross final consumption of all forms of energy, increased only by 6%.

We believe that, in order to increase the accuracy of the CER assessment, for other states and the EU, it would be necessary that the accredited institutions (INS, EUROSTAT) to include in the statistical databases olso other ICEs, the most relevant being: the specific reserves of the REE, the specific potential of RER - with economic potential , EE availability to consumers, final energy intensity, GHG emissions of energy processes, quantity of solid particles generated by energy processes, with negative impact on the environment.

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