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Changes in the regulation of the electricity sector as a factor in stimulating economic development in Poland in 2000-2014

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Abstract. Since the beginning of systemic and economic transformation in Poland in the 90s, there have been rapid institutional, restructuring and regulatory changes in the electricity sector. State monopoly has been replaced by a regulation for competition and the sub-sectors of manufacturing and trading have been subjected to liberalization processes. Due to the socio-economic importance of electricity, regulatory changes made in the electricity sector may be a stimulant or destimulant for Polish economic development. The article is an attempt at an assessment of the changes that have taken place in the electricity sector and of the impact of it on Polish economic growth. The analysis showed that regulatory changes had a negative effect on the level of prices for industrial customers and the level of economic growth, and has been beneficial from the point of view of investment and environmental protection.

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INTRODUCTION

Since the 80s in the EU a transformation in the utilities, including the electricity sector, the transformation process was taking place. In later years a similar transformation took place in Poland. With the start of the political changes in Poland, a major transformation of the electricity sector has taken place. This coincided at the same time with the change of approach to the role of the State in infrastructure sectors. It was found (Jordan 1972; Stigler 1971; Tullock 1967) that the State's role should be limited, because regulation instead of serving the public interest, gives an advantage to interest groups to a greater extent than the whole of society, resulting in low cost efficiency of enterprises, high prices of goods and services offered to consumers and businesses and a socio-economic loss for country. These views were influenced and guided by changes that were being made to the infrastructures in the EU countries. The precursor of these changes was the United Kingdom, for which other countries began to follow, as well as Poland. The British reform package had four dimensions: privatisation, unbundling of the transmission network from generation and supply; price regulation by an independent office and lifting of restrictions to market entry (see Newbery 2000, Newbery and Pollitt 1997, Pollitt, 2008). For this reason, since the early 90s in the electricity sector in the

UK, and later in the Nordic countries, the liberalization processes began to be carried out consisting, on one hand the change in regulatory rules and on the other hand an increase in the level of competition. In 1997 by the directive 96/92/EC, the European Union decided to liberalise its electricity markets. A change in the type of regulation was to discontinue the general supervision of the sector by the State and is represented by the government, to create a specialized sectoral regulatory authority and includes the power industry in direct supervision by the regulator. Over time, such regulatory changes began to be implemented in all EU Member States, including Poland. The energy supply was opened up for competition. It was decided to enable all business consumers to freely choose their supplier by mid-2004, and private households since the end of 2007. Besides, at the end of 2007, it was achieved by unbundling (separation) of network activities from other electricity activities. Thus, from this moment the network activity operates in conditions of natural monopoly and is subject of ex ante regulation, and the sales and production of electricity operate within a competitive market.

It was similar in Poland. Before 1999, the electricity sector has acted as single company, which is national monopoly. Then following the example of the UK it was decided in Poland to complete the restructuring for one company to control electricity transmission, 33 distribution companies and generation companies. It was also decided that the electricity sector will not be managed by the government and will be subject to sectoral regulation. The beginning of regulatory transformation in the electricity sector in Poland was the creation of a regulator, called the President of the Energy Regulatory Office (ERO) in 1999 under the Energy Law Act. Since 2000, electricity prices have ceased to be officially set by the Minister of Finance, and began to be approved by the sectoral regulator. Initially, cost of service regulation method was used, allowing companies to cover all reasonable costs of operations, and a few years later it was replaced by incentive regulation method, the so-called price cap method RPI-X, designed to force the companies to care about minimizing costs. These changes in the regulation of electricity prices were accompanied by slow changes in the functioning of the electricity sector. Four subsectors have been created, from which was created electricity market. In addition, the sales sub-sector was slowly opened to competition, by enabling the next groups of end-users buying electricity from alternative energy suppliers, the so-called third-party access (TPA). In mid-2007, retail electricity market in Poland has been fully opened to competition. In the same period, under Directive 2003/54/EC it has also been made unbundling of network from other activities in power companies, which resulted in the establishment of the incumbent suppliers and distribution system operators. From that moment we can say that electricity market began to exist in practice. In the meantime, the electricity prices for industrial consumers were exempted from the obligation to submit for approval by the regulator in 2008.

According to Hawdon (2003), the effects of regulatory reform have been critically important in many countries. Pearce (2006), for instance, insists that many governments worldwide have major concerns with the influence of regulation on competitiveness (Chang, Berdiev 2011, p. 816). As emphasised Pitlik (2007), government interventions may generate unfavorable outcomes for the society, however, also suggests that some regulations are "crucial for the functioning of a market economy" (Pitlik, 2007, p. 161). Due to the fact that such volatile regulatory changes have taken place in the electricity sector in Poland, there is a need to assess whether they had a positive or negative impact on the level of socio-economic development of the country. Estimation of this problem is the main purpose of the work. In order to achieve this objective, the author attempted to evaluate and compare the changes in the level of electricity prices and changes in the level of GDP in the period when the market was strongly regulated, ie. 2000-2007, and at a time when electricity sector was significantly liberalized, ie. 2008-2014. In addition, the analysis of the level of investment measured by the level of newly installed capacity has been carried out. In the paper it was assumed a hypothesis that the liberalization of the electricity market in Poland had a positive impact on the level of economic development, both in terms of prices, the level

of investment in generation capacity, as well as environmental protection. In empirical part of article was used data from the Central Statistical Office of Poland (CSO), Eurostat and the Energy Market Agency of Poland.

LITERATURE REVIEW

The literature of the subject has a different approach to the problem of regulation and assessment of its impact on the electricity markets. Economists who believe that regulation should be in the public interest recognize that in sectors such as the power industry, which „is vulnerable to monopolization, unfair competition, information asymmetry and the presence of externalities", the regulation is useful, because it „reduces market failures and in this way increases social welfare" (Nagaj 2014, p. 101). Quite a different view is shown by representatives of the school of private interest. According to their representatives, the regulation is introduced for the benefit of interest groups and only serves them. For this reason, public interest is not implemented or is carried out only in limited scope, ie. when it is not in opposition to the private interests of pressure groups. As pointed by Friedland and Stigler (1962), who studied the effects of regulation on the electricity markets in the US, the regulation does not deliver the expected results in the form of lower prices and bills for households and industry consumers (Friedland, Stigler, 1962, In: Nagaj 2013a, p. 46). Conway and Nicoletti (2006) argue that the regulation process reduces competition in the industry, generates inefficiency for the economy and social loss. But as Ogus wrote "both sets of theories are nevertheless helpful in focusing attention on how the different institutions of regulatory decision-making can be used either to advance the ostensible goals of regulation or else to subvert those goals to private ends." (Ogus, 2004, p. 42).

Meanwhile Jamasb and Pollitt (2011) analysing changes in UK's electricity market noticed that liberalisation has had a marked effect on innovative activities in the electricity industry. In particular, electricity reforms have resulted in a reduction in R&D spending in the sector. But they emphasis that electricity related patents in non-nuclear and renewable technologies have increased in the post-liberalisation period. They attribute this trend to the increased commercialisation of the sector. While this development is positive, they argue that a lasting decline in R&D will in the longer run reduce technological progress and innovation in the sector (Jamasb, Pollitt, 2011, p. 309). Generally, literature of the subject points out that deregulation contributed to the decline in investment in the electricity market. As noted by Kinnunen (2006) "the net investments were at a lower level after deregulation, even though the consumption of electricity had risen" (in Antonsen et al., 2010, p. 213). As pointed by Pompei (2013), deregulation is also not useful for the improvement of productivity. The analysis of the effect of the stringency of regulation on total factor productivity growth in the electricity sectors of 19 European Union countries for the period 1994–2007 was done by Pompei. The results of his studies showed that the stringency of regulation doesn't influence negatively on production effect in electricity sector. "Only the stringency of entry regulation significantly reduces technological change, whereas vertical integration exhibits a negative and significant impact only on the catching up process (pure efficiency change)". Their analysis showed that only public ownership "guarantee improvements in reaching the optimal scale of production" (Pompei, 2013, p. 569).

Lise and Kruseman (2008) note, however, that a liberalized electricity market is very beneficial for the economy, but only if the competition will be very high. Their studies have provided evidence "that perfect competition leads to lower prices and benefits the environment in the form of lower acid and smog emissions. Continued exercise of market power leads to postponed investments and more diversity in the technology portfolio" (Lise, Kruseman, 2008, p. 230), whereas in a competitive market it is more likely that more environmentally friendly technologies will be implemented.

However, as Nagayama (2009) observed during his research "higher electricity prices are one of the driving forces for governments to adopt liberalization models. However, the development of liberalization models in the power sector does not necessarily reduce electricity prices. In fact, contrary to expectations, there was a tendency for the price to rise in every market modeled" (Nagayama, 2009, p. 463). Analysis of the impact of reform of the electricity market at a time when the markets were heavily regulated (Steiner 2001, Hattori and Tsutsui 2004) indicated that "electricity market reforms generally induced a decline in the industrial price and an increase in the price differential between industrial customers and residential customers, indicating that industrial customers benefit more from the reform" (Erdoglu 2011, p. 1081). Results of Nagaj's studies (2013b) showed that in the years 2000-2011 electricity prices increased in all EU countries, but in countries where prices were not regulated there was observed a higher amplitude of fluctuations in electricity prices in the short term. In addition, in the long term electricity prices for households increased to a lesser extent in countries where prices were subject to ex ante regulation. Results of studies of Chester and Morris (2011) additionally show that the effects of reforms in the electricity markets were felt mainly by the poorest. As they underlined „some European prices rose by more than 100 percent between 2000 and 2010. (…) Growing numbers of low income and vulnerable households are spending higher proportions of disposable income on energy bills and suffer deprivation and social exclusion as a result" (Chester, Morris, 2011, p. 435). Meanwhile results of investigations of Moreno et al. (2012) suggest that in countries, where liberalization has led to a reduction of market concentration, prices for households were falling under the influence only of reforms in the electricity market. The observed increase in electricity prices was mainly caused by the deployment of RES-E. These findings were also underlined by Stankova et al. (2010). Their findings also indicated that "the electricity prices become lower when cross-border electricity transmissions are allowed. Generally in perfect competition the producers tend to use cheaper and non-environmentally friendly means of electricity production, so the emission restrictions are needed to motivate the electricity producers to act more ecologically" (Stankova et al., 2010, p. 278).

METHODOLOGY

A literature review indicated that the primary effect of the reforms in the electricity markets are changes in electricity prices, the consolidation processes resulting in increased market power of business and declining investment in production capacity. Among them, the impact on socio-economic development within Poland have mainly affected prices for end-users, and investments in power capacity, which determine the level of energy security, environmental quality and level of economic prosperity. A relationship for electricity prices will be defined by comparing the level of the dynamics of changes in prices for end-users with dynamic of changes in GDP in the studied period. In the analysis was used prices measured by purchasing power standard. For this purpose, it will be examined the correlation between change in electricity prices and change in GDP by the Pearson correlation coefficient. The verification of the statistical hypothesis about the significance of the correlation coefficient of a set of hypotheses:

H_0: $\varrho=0$ (the correlation between variables is not statistically significant),

H_1: $\varrho\neq0$ (the correlation between variables is statistically significant),

will be made using t-Student test

$$t = \frac{r_{yx}}{\sqrt{1-r_{yx}^2}} \cdot \sqrt{n-2} \ .$$

Significance level is $\alpha = 0.05$.

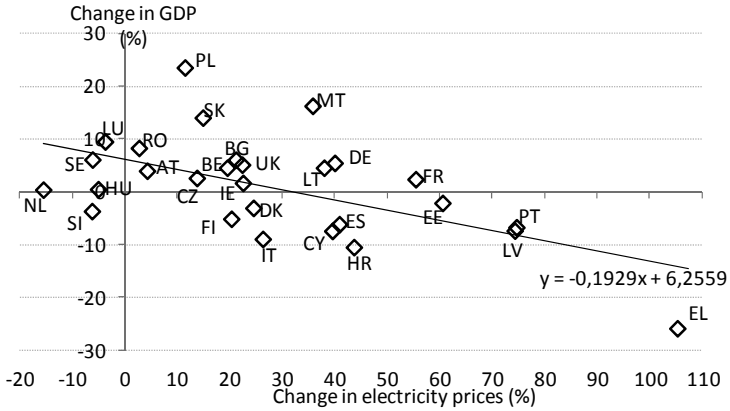
In addition the relationship between change in electricity prices and change in GDP will be tested using regression analysis, where the dependent variable is change in GDP and the independent variable is the change in electricity prices in studied period. This method will be used to examine the relationship both for the EU Member States (the change of the variables in the EU Member States is examined), and for Poland (the relationship between variables in studied period is examined). To statistical calculations was used Statistica 12.0 program.

The research process and the assessment whether the liberalization processes influenced positively or negatively on the economic growth will be carried out by comparing the level of changes in variables over the years 2008-2014 to the years 2000-2007. The adoption of such research periods is due to the fact that in mid-2007 was made a full opening of the market to competition and unbundling, which resulted in the fact that electricity market in Poland began in practice to operate in accordance with the mechanisms of competition. Meanwhile the period up to 2007 was a period of relatively strong regulation in the electricity sector and control prices for households and businesses.

The effect of influence of the investments on socio-economic development will be examined by analyzing changes in the level of new electricity capacity installed and the impact of it on the environment, measured by the level of renewable energy sources used for electricity production and the level of greenhouse gases emitted by the electricity sector. In this way, it will be examined whether investments in power industry increased or decreased as a result of regulatory transformation and how it affected on the quality of life of society.

RESULTS

Analysis of the literature indicated that the primary effect of the reforms in the electricity markets in the EU have been rising prices (Chester, Morris, 2011; Moreno et al. 2012; Stankova et al. 2010). Due to the fact that electricity prices represent a significant portion of a businesses's costs it can be assumed that price developments should impact on economic growth. For this purpose, it was shown in Figure 1 the comparision of the changes in the level of electricity prices for industrial consumers in 2008-2014 with the change that has taken place in the level of GDP in the same period for the EU Member States.



* Currency: purchasing power standard; Band: IB, Consumption = (20 MWh; 500 MWh).

Figure 1. GDP change and change in electricity prices for industrial consumers* in 2008-2014
Source: own calculations based on Eurostat data.

Data analysis showed that in most EU countries (21 of 28) the rate of increase in electricity prices for industrial consumers was higher than the rate of change in GDP. It is also worth noting that in countries where the largest increases in electricity prices was observed, ie. Greece, Portugal, Latvia, Estonia, there was a decline in GDP in the studied period. The analysis of correlation between change in GDP and change in electricity prices for industrial consumers showed that there is negative correlation of medium strength between the studied variables. The correlation measured by the Pearson correlation coefficient is -0.57. Statistical verification (the t-statistic is -3.53 and the critical value $t_{0.05}(26)$ is 2.056) indicated that the null hypothesis about the lack of statistical significance of the correlation coefficient should be rejected. So it can be concluded that the negative correlation between change in GDP and change in electricity prices for industrial consumers is statistically significant and has moderate strength.

Table 1

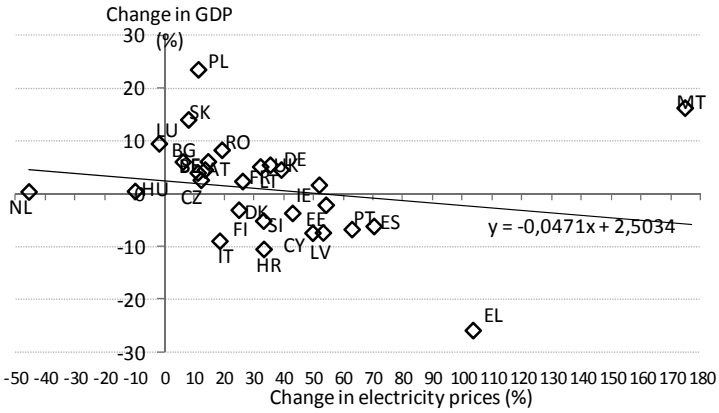
Results of regression analysis between change in GDP (Y) and change in electricity prices for industrial consumers (X_1) in 2008-2014 for EU Member States

N=28	Regression statistics: R=0.56936322; R^2=0.32417448; Adjusted R^2=0.29818119; F(1,26)=12.471; p<0.00157; Std. Error of the Estimate=7.9914.					
	Standardized Coefficients		Unstandardized Coefficients		t-statistic	p value
	b*	Std. Error	b	Std. Error		
Constant			6.255941	2.139446	2.92409	0.007071
Variable X_1	-0.569363	0.161224	-0.192885	0.054619	-3.53150	0.001566

Source: own calculations based on Eurostat data.

Regression analysis (Table 1) showed that there was a negative relationship between changes in the electricity price for businesses and changes in GDP in the studied period. The rise in prices by 1 percentage point was accompanied by drop in GDP by 0.19 percentage point. However, it should be added that the changes in electricity prices for businesses explained the variability of change in GDP only in 32.4%.

Regulatory changes and reforms in the electricity market include not only the supply side of the economy, but also the demand side, because they are related to the evolution of electricity prices for households and thus their level of consumer spending. Figure 2 shows how electricity prices for households and the volume of GDP in the EU Member States have changed over the period 2008-2014.



* Currency: purchasing power standard; Band: DB, Consumption = (1 000 kWh; 2 500 kWh).

Figure 2. GDP change and change in electricity prices for households* in 2008-2014

Source: own calculations based on Eurostat data.

Table 2

Results of regression analysis between change in GDP (Y) and change in electricity prices for households (X_2) in 2008-2014 for EU Member States

N=28	Regression statistics: R=0,1951879; R^2=0,0380983; Adjusted R^2=0,0011021; F(1,26)=1,0298; p<0,31956; Std. Error of the Estimate=9,5339.					
	Standardized Coefficients		Unstandardized Coefficients		t-statistic	p value
	b*	Std. Error	b	Std. Error		
Constant			2.503393	2.393605	1.04587	0.305249
Variable X_2	-0.195188	0.192344	-0.047136	0.046449	-1.01479	0.319559
without Malta						
N=27	Regression statistics: R=0.61076398; R^2=0.37303263; Adjusted R^2=0.34795394; F(1,25)=14.874; p<0.00072; Std. Error of the Estimate=7.4530.					
	Standardized Coefficients		Unstandardized Coefficients		t-statistic	p value
	b*	Std. Error	b	Std. Error		
Constant			5.961280	2.045173	2.91480	0.007403
Variable X_2	-0.610764	0.158363	-0.195874	0.050787	-3.85675	0.000715

Source: own calculations based on Eurostat data.

Data analysis showed that in most EU countries (23 of 28) electricity prices measured by purchasing power parity, increased during the studied period more than GDP, which means that the share of expenditure on electricity households in relation to income increased over the period 2008-2014. This means that households have less and less funds available to spend on consumption of non-energy goods and services. Correlation analysis indicates, however, that prices for households are poorly correlated with economic growth (-0.20) and correlation coefficient is statistically insignificant (the t-statistic is -1.0148 and the critical value $t_{0.05}(26)$ is 2.056). While in the case of industrial consumers correlation between prices and GDP was statistically significant, negative and had a medium level of strength (-0.57), whereas in the case

of households, the Pearson correlation coefficient was only -0.20. In addition the regression analysis (table 2) showed that there is no statistical dependence between the change in electricity prices for households and the level of change in GDP in the EU Member States. It should be noted, however, that if Malta, which for the whole studied period had a closed market to competition, had not been taken into account, the Pearson correlation coefficient would have been -0.61. Such level of coefficient would heve been statistically significant (the t-statistic is -3.86 and the critical value $t_{0.05}(25)$ is 2.060) and would have implied the existence of a negative correlation at medium intensity between change in electricity prices for households and the change in GDP. Leaving aside the case of Malta, the regression analysis (Table 2) showed that there was a negative relationship between changes in electricity prices for households and changes in GDP in the EU in the studied period. The rise in prices by 1 percentage point was accompanied by decline in GDP by 0.2 percentage point. In this case, changes in electricity prices for households would have explained the variability of change in GDP in 37.3%. It is worth noting that Poland is not in line with the European trend, because it is one of the few countries where prices for households have increased much less than GDP. A possible explanation of this phenomenon is the regulation of these prices (throughout the studied period prices for households, unlike the prices for businesses, were controlled and approved by the regulator).

Analysis of changes in electricity prices and GDP for the EU Member States indicated that higher and higher price increase was accompanied by less and less the change in GDP. This applies to both businesses (industrial consumers) and households. Meanwhile, in Poland the such relationships occurred only in 2000-2007. The results of analysis of the relationship between these variables in Poland in the years 2000-2014 are presented in Table 3.

Statistical analysis of the data indicated (Table 3) that in Poland there was relatively strong negative correlation between GDP and end-users electricity prices only in 200-2007. However, it is worth noting that statistically significant correlation concerned only households and Intensive Industry, but not business users (t-statistics for households is -2.68, for business users is -0.67 and for industry is -2.68, at the critical value $t_{0.05}(5)$ equal to 2,571). Regression analysis confirmed that there were relationships between these variables only in 2000-2007. However, the volatility of changes in GDP was explained by changes in the price of electricity only in about 50%. Statistical analysis also showed that in the later period, there was no such relationships (neither correlation nor impact of prices on GDP).

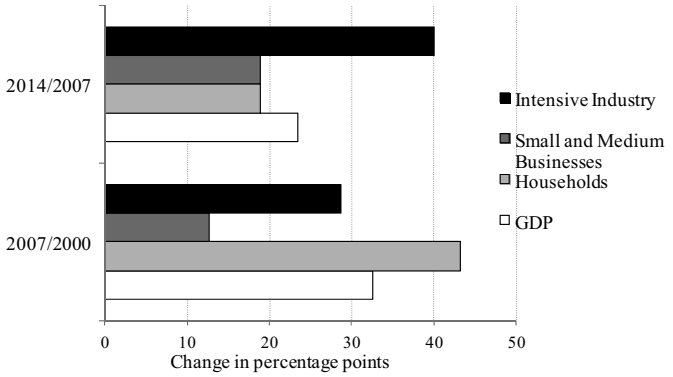
However, did the liberalization of the electricity market in Poland have a negative impact on the level of economic growth by increasing electricity prices? The answer to this question seeks to provide analysis, the results of which are shown in Figure 3. Here was presented the change in GDP and electricity prices for end-users in Poland in the years 2000-2007, when the market was subject to strong regulation and in the years 2008-2014 when the electricity market in Poland was opened up to competition and was after the unbundling of network activities from sales and manufacturing.

Table 3

Results of regression analysis between change in GDP (Y) and change in end-users electricity prices in Poland (X_1, X_2, X_3) in 2000-2014

For Households in 2000-2007						
N=7	Regression statistics: R=-0.76727; R^2=0.58871; Adjusted R^2=0.50645; F(1,5)=7.1568; p<0.04407; Std. Error of the Estimate=1.5289.					
	Standardized Coefficients		Unstandardized Coefficients		t-statistic	p value
	b*	Std. Error	b	Std. Error		
Constant			5.098233	0.682378	7.47128	0.000678
Variable X_1	-0.767272	0.286808	-0.231389	0.086494	-2.67521	0.044072
For Households in 2008-2014						
N=7	Regression statistics: R=0.00324; R^2=0.00001; Adjusted R^2=n.a.; F(1,5)=0.00005; p<0.99451; Std. Error of the Estimate=1.4705.					
	Standardized Coefficients		Unstandardized Coefficients		t-statistic	p value
	b*	Std. Error	b	Std. Error		
Constant			3.060931	0.619626	4.939962	0.004322
Variable X_1	0.003236	0.447211	0.000752	0.103901	0.007236	0.994506
For Business users in 2000-2007						
N=7	Regression statistics: R=-0.28576; R^2=0.08166; Adjusted R^2=n.a.; F(1,5)=1.44458; p<0.53445; Std. Error of the Estimate=2.2845.					
	Standardized Coefficients		Unstandardized Coefficients		t-statistic	p value
	b*	Std. Error	b	Std. Error		
Constant			4.419348	0.968197	4.564511	0.006032
Variable X_2	-0.285756	0.428566	-0.074456	0.111666	-0.666772	0.534447
For Business users in 2008-2014						
N=7	Regression statistics: R=-0.07755; R^2=0.00601; Adjusted R^2=n.a.; F(1,5)=0.03025; p<0.86875; Std. Error of the Estimate=1.4660.					
	Standardized Coefficients		Unstandardized Coefficients		t-statistic	p value
	b*	Std. Error	b	Std. Error		
Constant			3.092981	0.580453	5.328560	0.003118
Variable X_2	-0.077546	0.445867	-0.010433	0.059989	-0.173921	0.868750
For Industry in 2000-2007						
N=7	Regression statistics: R=-0.76785; R^2=0.58959; Adjusted R^2=0.50751; F(1,5)=7.1830; p<0.04381; Std. Error of the Estimate=1.5272.					
	Standardized Coefficients		Unstandardized Coefficients		t-statistic	p value
	b*	Std. Error	b	Std. Error		
Constant			5.232489	0.709397	7.37597	0.000720
Variable X_3	-0.767848	0.286499	-0.337531	0.125940	-2.68011	0.043815
For Industry in 2008-2014						
N=7	Regression statistics: R=0,21923; R^2=0,04806; Adjusted R^2=n.a.; F(1,5)=0,25243; p<0,63671; Std. Error of the Estimate=1,4347.					
	Standardized Coefficients		Unstandardized Coefficients		t-statistic	p value
	b*	Std. Error	b	Std. Error		
Constant			2.960438	0.579355	5.109889	0.003739
Variable X_3	0.219226	0.436335	0.016877	0.033592	0.502426	0.636709

Source: own calculations based on Eurostat data.



* Prices in National Currency.
** Households: Band: Db, Consumption = (1 000 kWh; 2 500 kWh).
Small and Medium Businesses: Band: Ib, Consumption = (20 MWh; 500 MWh).
Industry: Band Ie, Annual consumption = (20000 MWh; 70000 MWh).

Figure 3. Change in GDP and electricity prices* for end-users in Poland in 2000-2014**
Source: own calculations based on Eurostat data.

Analysis of the data indicated that, with the exception of households, liberalization processes negatively affected the situation of end-users. The increase in electricity prices for Intensive Industry and for small and medium businesses in years 2008-2014 was higher than in years 2000-2007 respectively by 11.3 percentage points and 6.3 percentage points. Meanwhile, the increase in prices for households over the period 2008-2014 amounted to 18.8% and was lower by 24.4 percentage points than in 2000-2007. This may mean that electricity companies have applied cross-subsidization and compensated in such a way (by the higher growth of prices on the liberalized market - for industry) no possibility to increase prices on the regulated market (households).

It is worth noting that in 2008-2014, ie. a high increase in electricity prices for the industry, the growth of production was lower than the change in prices (unlike in 2000-2007). The result was a loss of competitiveness of the Polish economy, because the production costs associated with the expenditure for electricity increased significantly, overtaking the dynamics of the production effect.

Referring to the prices for households which were regulated throughout whole studied period, it should be emphasized that the decline in the growth of prices was due to the change in the method of regulation. Referring to the prices for households throughout the research period were regulated, it is worth noting that the decline in the dynamics of the increase in prices was caused by the change in the method of regulation. For first two years the cost of service regulation method was used, which caused marketization of electricity prices. Moreover, until 2007 it was gradually increased the proportion of assets from which the remuneration is included in the tariffs. Due to the fact that the whole electricity market was opened to competition in 2007, the sector regulator using RPI-X regulation method tried to protect households and strongly reduced the scale of price changes.

As a result of reforms to the electricity market, the effects were evident also in the level of investment. Figure 4 shows the level of new electricity capacity installed in Poland in 2000-2013.

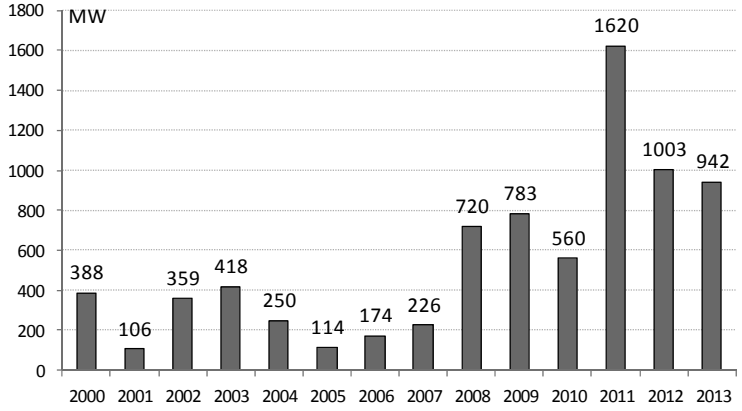


Figure 4. New electricity capacity installed in Poland in 2000-2013

Source: Statystyka elektroenergetyki polskiej 2006 (Statistics of Polish Power industry), Agencja Rynku Energii, Warszawa 2007, p. 55; Eurostat data, http://ec.europa.eu/eurostat/statistics-explained/images/7/7b/New_capacity_connected_during_the_year_2013_%28MW%29.png, 08.12.2015.

The data indicate that the liberalization processes had a positive impact on the propensity to invest, which resulted in an increase in the volume of new electricity capacity installed in Poland. It should be emphasized that after liberalization of the electricity market in Poland, new electricity capacity was increased each year than in any year between 2000-2007. The probable result of such behavior by companies were rapidly growing electricity prices, which increased return on investment. These phenomena are beneficial from the point of view of economic development, which is due to two reasons. Firstly, the level of energy security increases, which provides greater assurance of continuity of electricity supply to consumers and businesses. Secondly, investments, by the multiplier process, ensure the income effect and production effect in the economy, which translate into higher economic growth.

More new power capacity installed also results in greater energy efficiency of power companies, which translates into lower negative impact on the environment. It is worth noting that a significant portion of investments in power capacity related to renewable energy sources. Figure 5 shows the share of renewable energy sources in electricity in Poland.

The data analysis shows that capacity of power plants using renewable sources for electricity generation was higher year by year, what results in higher share of renewable energy (RES) in electricity in Poland. It is worth noting that the opening of the electricity market to competition greatly accelerated these trends. The achievable capacity of power plants from renewables in 2000-2007 increased by 471 MW, whereas in years 2008-2013 the increase was eight times (by 3815 MW). It is true that it was significantly affected by regulations concerning climate policies and actions to support the RES, however, it does not change the fact that the processes of liberalization really supported these trends. These climate changes have an influence on improving the quality of the environment, which improves the level of socio-economic development. Table 4 shows what was the total emission of greenhouse gases to the power industry in Poland in 2003-2013.

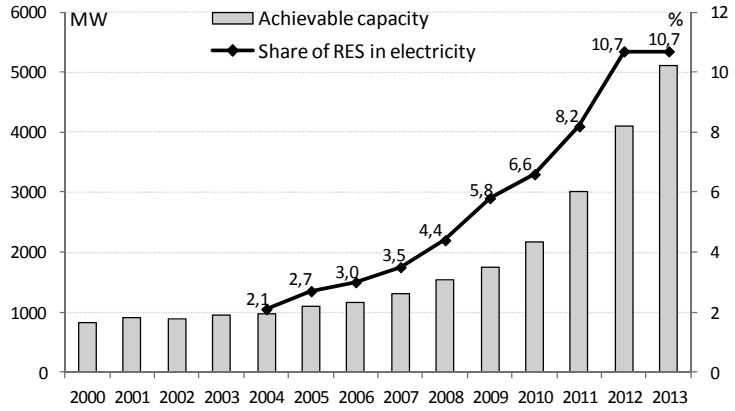


Figure 5. Share of renewable energy in gross electricity consumption in 2004-2013 in Poland (in %) and achievable capacity of power plants using renewable sources for electricity generation (in MW) in Poland in 2000-2013

Source: Energy from renewable sources in 2006, the Central Statistical Office of Poland, Warszawa 2007, p. 42; Energy from renewable sources in 2013, the Central Statistical Office of Poland, Warszawa 2014, p. 66.

Table 4

Total emission of greenhouse gases by power industry (in gigagrams)

	2003	2007	2013
Carbon Dioxide	182213.3	181993.0	169172.05
Methane	1.8	3.0	4.49
Nitrous oxide	2.6	3.0	2.70

Source: Environment 2005, Central Statistical Office, Warsaw 2005, p. 218; Environment 2009, Central Statistical Office, Warsaw 2009, p. 232; Environment 2015, Central Statistical Office, Warsaw 2015, p. 224.

The data clearly show that carbon dioxide emissions in the whole studied period was falling, but in 2008-2013 the drop in emissions was greater than in 2003-2007. While in 2003-2007, the total emission of carbon dioxide dropped by 0.03% a year, in 2008-2013 by 1.21% a year. This means that the reforms that have taken place in electricity sector, which included also the liberalization, had a positive impact on the quality of the environment.

CONCLUSIONS

In this paper the analysis of the effects of reforms and regulatory changes in the electricity market in Poland in relation to the level of Polish economic development in 2000-2014 was carried out. These reforms consisted of privatization and restructuring of enterprises, liberalization of sales and production of electricity

and the change in the rules of regulation. In order to analyze, within the period of the study a comparison was made of the effects of changes in the electricity sector in the years 2000-2007, when the market was subject to strong sectoral regulation and in the years 2008-2014, when the electricity market was opened to competition and was largely a liberalized market. The subject literature is not entirely unanimous in assessing the impact of these changes in electricity markets in the EU Member States. However, the dominant view is the view that the main effects are an increase in electricity prices for end-users and decrease in the propensity to invest. Analysis carried out for the electricity market in Poland has indicated that liberalization has led to rapid increase in prices for the industry, faster than economic growth and an increase in propensity among power companies to invest in new electricity capacity. The tangible result of regulatory changes is also the increase in the share of renewable energy sources in electricity production. So if two of the three effects of changes in the electricity sector had a positive impact on the socio-economic, changes in the electricity sector must therefore be positively verified. Problems presented in the article, however, still require further in-depth research.

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