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## Financial management in electric utilities on liberalized market: cross-country analysis

### Abstract

Electric utilities will have to become more competitive in the future because of the increasing high level of financial performance existing in the current and future electricity market. The Russian electricity sector is especially challenged to meet this high level as it was recently restructured. Thus, Russian electric utilities are having to manage their activities under new market conditions. Because Russian national electric utilities companies have very little real experience in its new structure, they should look to find international examples to guide them in development of their governance strategy. This paper provides empirical finding using the clustering method that analyzes twelve electric utilities from the following countries: Russian Federation, China, France, Germany and the United States. This study has two major goals: (1) first, we want to determine if there are similarities in financial management among electric utilities on the electricity market in the different countries, also (2) we want to find out if the decision-making process reflects only national features. If so then each individual country might be better served developing its own strategy. With the help of a self-organizing map, we found that since 2002-2012 financial management hasn't had common rules – at least for the countries included in our research. Thus, there are no standard rules that Russian electric companies can follow. If we were to choose a country to learn about financial management and implementation for Russian electric utilities, our research indicates that the United States would be the most appropriate country for Russian utilities to follow.

**Keywords:** electric utilities, self-organizing maps, firm performance, electricity market.

**JEL Classification:** G320, L940, M041.

### Introduction

Russian electricity sector was recently restructured: new market model with new market players were created. In the XX century a lot of foreign countries created and developed competitive electricity market. When reform was announced the Russian electricity sector became the object of plenty research. Its experience seems to be unique – just a few countries (Russian Federation and USA) have federal structure where territories could differ drastically. From the one hand, researchers tried to answer the question whether de-regulation rules could be appropriate for such huge territory (Cooke et al., 2012), from the other hand some of them tried to find some examples to follow drawing on the experience of foreign countries (such as IEA members in [Russian Electricity Reform: Emerging Challenges and Opportunities, see <http://www.iea.org/textbase/nppdf/free/archives/russianelec.pdf>]), or just analyzed the opportunity to follow US example as restructuring process both in Russia and USA passed on relatively the same scenario (Meltenisova, 2013).

For sustainable development of Russian electricity sector main focus should be made on energy efficiency and green energy projects' implementation. However all innovations deal with additional costs so electric utilities have to learn how to manage their activities for increasing effectiveness and competitiveness on electricity market and remain financially successful.

With new electricity markets creation Russian electric utilities faced necessity to take effective decisions for increasing their financial performance and competitiveness. The problem was that they didn't know how to do it. International experience that was offered to follow could be inappropriate for Russian reality as its implementation required detailed empirical analysis of its opportunities and challenges. Moreover it was important to answer the main question – whether Russian companies should follow some rules in financial management or it will be better to develop their own strategy based on national features. That's why the aim of the paper is threefold: (1) first, we want to determine if there are similarities in financial management among electric utilities on the electricity market in the different countries, also (2) we want to find out if the decision-making process reflects only national features. If so then each individual country might be better served developing its own strategy.

The paper is organized as follows: Section 1 describes the literature overview and the hypothesis development; Section 2 describes the methodology of research; Section 3 presents the result of research and discussion. The final section concludes the paper.

### 1. Literature review and hypothesis development

**1.1. Literature review.** Aspects of firm performance evaluation and financial management have been studied from different points of view. Iazollino et al. (2012) make emphasize on intellectual capital, Agrawal et al. (1996) focus more on debt and

stakeholders' policy Meltenisova (2013) and Lang et al. (1994) analyzed financial management based on market and book value of companies' assets.

Financial performance is one of the necessary factor for company's competitiveness (Brio, 2003) and depends on plenty external and internal factors, and market structure is supposed to be one of the most important (Megginson, 1994; Dagdevigen, 2009; Meeus, 2005; Ageeva et al., 2011; Suslov, 2012). Megginson et al. (1994) presented research of financial performance of 61 companies from 18 countries and 32 industries (including electricity sector) that experience full or partial privatization. Finally authors found that restructuring process caused the increase in profitability, capital investment spending and operating efficiency. Dagdevigen (2009) continued investigation of financial performance and liberalization and author focused just on electricity market. Meeus (2005) made an attempt to provide empirical evidence about competitive electricity market and financial performance for EU countries. As a result Meeus et al. (2005) found similarities in financial management for electric utilities in different EU countries.

Despite of national features of electricity market in different countries there could be common similarities in financial management for electric utilities and some researches emphasized it. If so such similarities could be further used with Russian electric utilities for effective financial management. In our research we aimed to investigate this fact with clustering analysis. We used results presented in Meltenisova (2013, 2014) and Meeus et al. (2005) as starting point for our research and use them in hypothesis development.

**1.2. Hypothesis development.** As restructuring of electricity sector in some countries passed relatively the same scenario and some researchers found that market structure may influence on financial performance we assume that financial management in electric utilities could have similarities. So our main hypothesis is: *financial management in electric utilities has some common principles regardless country where company operates so national features are supposed to be insignificant.* To take national features into account we included electric utilities from different countries (Russian Federation, China, France, Germany and USA). To accept or reject hypothesis we use clustering method that allows to place objects (electric utilities from different countries) into several groups based on similarities in financial performance.

## 2. Methodology of research

We propose a methodology that could be divided into two parts: (1) at first we try to define key

factors of financial performance which are common for electric utilities from different countries and (2) second we use self-organizing map for finding out whether there are similarities in financial management for electric utilities in different countries.

**2.1. Factors of financial performance for electric utilities.** As we have already mentioned financial performance could be analyzed from different points of view (Iazollino et al., 2012; Agrawal et al., 1996; Meltenisova, 2013; and Lang et al., 1994). So for analyzing electric utilities first of all we had to define what factors we would include in our research. We supposed that electric utilities should pay attention to three main aspects in financial management: financial stability, profitability and effectiveness.

The importance of financial stability is explained with uncertainty on liberalized electricity market where electric utilities quite often face difficulties to forecast their activities. Moreover electric utilities are capital-intensive companies and so all projects require huge investments and attraction of additional funds. Analysis of financial stability as a key component of financial performance was also discussed in Gilley (2013) and its importance was emphasized for capital-intensive companies. So we also took this aspect into consideration. For financial stability we considered such indicators as networking capital, fixed to current assets ratio, current and quick liquidity ratios (Gilley, 2013).

Market uncertainty also means deregulated electricity prices and consequently difficulties in income prediction appeared. So the ability of electric utilities to be financially successful under these conditions is supposed to be significant part of financial management. This point of view was also discussed by Hansen (1989). That's why profitability was included in our analysis. For evaluating profitability of electric utilities we regarded such indicators as ROE (return on equity), ROS (return on sales) and ROIC (return on invested capital). It's important to mention that all these three ratios may also reflect management's effectiveness (Galey, 2013).

And the last but not the least the company will probably take effective financial decisions if your management has bad quality. So in analyzing financial management it's important to find out whether managers have ability to manage company effectively. So for including management's quality in our research we calculated inventory, assets, net receivables, net payables operation, financial and invested capital turnover ratios (Hansen, 1989).

**2.2. Cross-country analysis: data set.** We considered five countries with different level of electricity market liberalization. Short description and main characte-

istics of electricity market are presented in Table 1. We also provide the level of market regulation in Table 1 – whether electricity market is competitive or government regulates its operation. Information presented in Table 1 will help us further to interpret results of clustering analysis and explain the electric utilities' distribution in different groups.

So according to Table 1 we could find that in Russian Federation and China there is the highest level of government regulation and electricity market is less competitive there. In France there is also quite high level of market regulation (but lower than in Russia and China) that could be explained with high rate of nuclear generation. And so government tries to control all processes for providing energy safety.

We tried to choose electric utilities in these countries based on several requirements: (1) availability of data based on companies' annual reports for the period of 2002-2012, (2) company should operate predominantly on national market (this assumption was made for preventing effects of integration that is typical for EU countries). Second requirement also allows to include national features of electricity market in our research.

Electric utilities in countries and short description are also presented in Table 1. For Russian Federation we included RusHydro. RusHydro is the generation company that generates electricity using hydro resources. We wanted to consider only generation companies that operate on highly regulated electricity market. In Russia there are both retail and wholesale electricity markets, and TGCs and WGCs operate both on competitive (wholesale market) and regulated ones (retail market) that make them inappropriate for including in our research. At the same time RusHydro generates only on regulated market because of low cost generation to prevent monopoly power.

### 3. Analysis

**3.1. Results of clustering method.** To find similarities in financial performance of electric utilities in different countries we used clustering method. We did it with self-organizing Kohonen's map. These maps were made for all electric utilities based on eleven factors of financial performance that were mentioned above for the period of 2002-2012 that helped us to take into account dynamic component. Example of self-organizing map is presented in Appendix. Companies' distribution among clusters from 2002 till 2012 is presented in Table 2 (Appendix). As the number of clusters should be chosen by researcher we found that in our case we should use seven clusters. Less numbers demonstrated results when there were a lot of companies in one that

prevented further analysis of similarities and distinguish features in their financial performance. More numbers of clusters gave us empty clusters that also didn't make any sense for our analysis.

Except analysis of companies' distribution we also tried to define principles of clustering. We analyzed average rate of all factors for each cluster in each year to understand characteristics of companies in one cluster (average rates of factors for self-organizing map for 2012 are presented in Table 3, Appendix). Such analysis helps us to find similarities for electric utilities in one and neighboring clusters.

### 3.2. Analysis of companies' distribution in clusters.

We analyzed Kohonen's map and companies' cluster for ten years (Table 2, Appendix). According to Table 2 we could conclude that Russian and Chinese electric utilities (RusHydro and Huaneng) for all ten years were placed separately from all other companies and next to each other. At the same time despite of high level of market regulation in both countries – China doesn't have competitive market and for Russia in our analysis we used RusHydro (company operates on highly regulated market) – Chinese and Russian electric utilities weren't placed in one cluster during research period. So we could assume that liberalization level doesn't influence of companies' financial performance as we didn't find similarities in case of highly regulated market in Russia and China.

RusHydro is located in cluster with the least turnover ratio among all electric utilities. In Table 3 (Appendix) company had negative return ratios as company didn't have income and faced loss this year. Chinese Huaneng's cluster is also characterized with low level of turnover ratios in comparison with EU and US electric utilities, but they are higher than Russian ones. So we could assume that high government regulation on electricity market doesn't create incentives for managers to work effectively.

European countries first were located in neighboring clusters and in 2011-2012 they moved into one. It could be explained as increasing significance of EU electricity markets' integration. A lot of European companies have generation capacities and operate in different countries in Europe. However one company in Europe differs from others despite of close location to them. It's EnBW (Appendix, Figure 1). Cluster with European companies is usually characterized with the highest level of current and quick ratios and networking capital and the least level of current to fixed assets ratio. These facts mean that European companies from 2002 to 2012 had high level of liquidity and networking



capital that testifies their financial stability and ability to pay their debts better than electric utilities in Russia, China and European countries.

Almost all US companies are located next to each other and never during 10 years weren't placed with Chinese, Russian or EU ones in the same cluster. It means that financial management in US differs from other countries. However like Chinese electric utilities, some US companies are located in the neighboring cluster with RusHydro. It could be explained with similar restructuring process both in Russian and US electricity sector.

Also US electric utilities are located in different clusters. Xcel Energy and PublicServiceEnterprise are placed in cluster with low level of return ratios (lowest among US electric utilities), at the same time PPL is located in cluster with the highest level of return ratios not only in USA, but also among EU, Russian and Chinese electric utilities. Consolidated Edison and FirstEnergy from 2002 till 2012 characterized with the highest level of fixed assets to current assets ratio. Besides restructuring process in electricity sector in the USA was held only in several states, electric utilities that operated on highly

competitive market were placed in the same cluster with ones on regulated electricity sector.

## Conclusions

Based on received results our hypothesis was rejected – we found that financial management doesn't have common principles regardless country where electric utilities operate and national features play a significant role. Decision making process isn't the same in countries with similar electricity market's model.

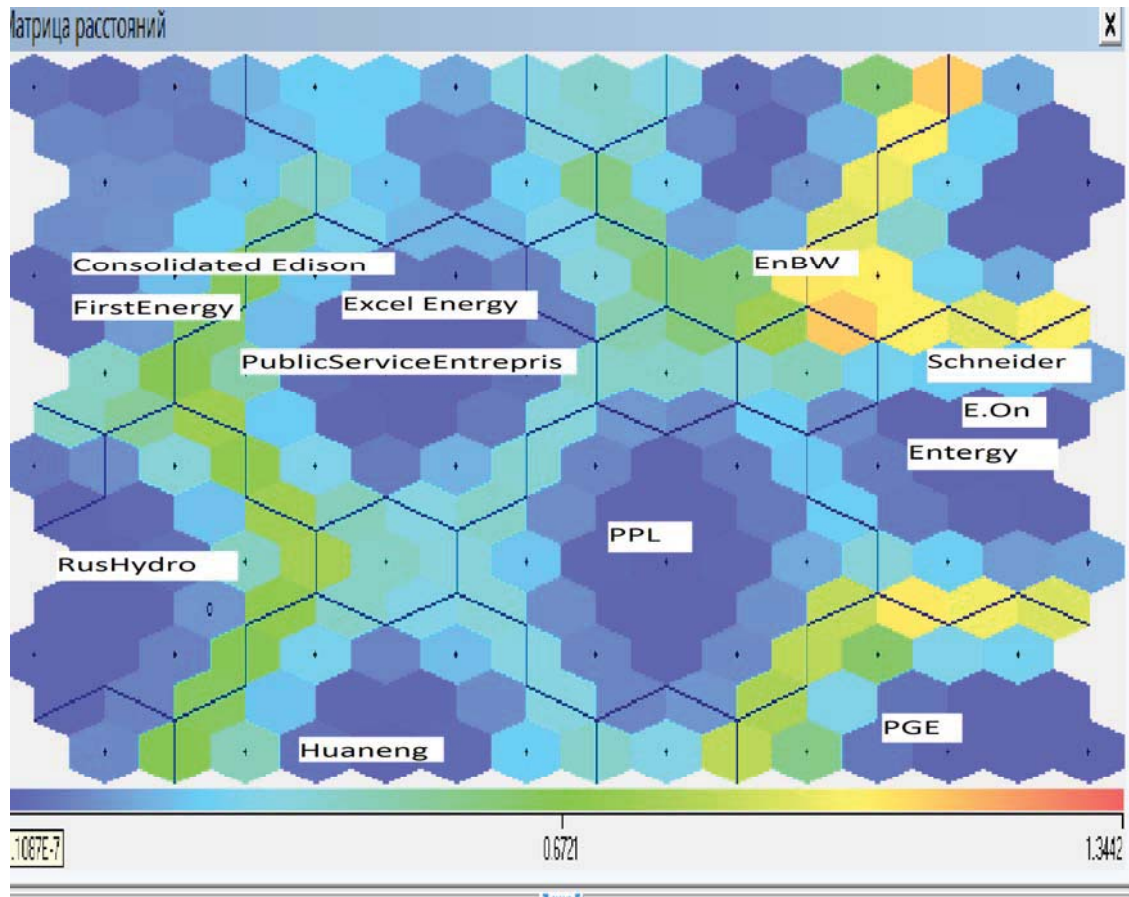
With the help of a self-organizing map, we found that during 2002-2012 financial management hadn't had common rules – at least for the countries included in our research. Thus, there are no standard rules that Russian electric companies can follow. If we were to choose a country to learn about financial management and implementation for Russian electric utilities, our research indicates that the United States would be the most appropriate country for Russian utilities to follow. RusHydro also should pay more attention to turnover ratios as they are the lowest in comparison with US and European electric utilities included in our research.

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## Appendix



**Fig. 1. Self-organizing Kohonen Map for electric utilities in 2002**

**Table 1. Electricity market and electric utilities in different countries**

№	Country	Electricity market	Companies included in research	Regulation
1.	Russian Federation	Electricity market was recently restructured in the country, wholesale and retail ones were created. Functions were divided into monopoly (transmission, nuclear and hydro generation) and competitive ones (generation, service).	RusHydro – Russian generation company, that is under government control because of low cost production for preventing monopoly power on wholesale market.	High
2.	China	Electricity market in China is regulated in all spheres as it's considered to play a strategic role in economic development.	Huaneng <sup>1</sup> – Chinese generation company that has more that 75% state owned and 25% by foreign investors. Company provides information for investors on its web-site (annual reports and etc.)	High
3.	Europe/Germany	In Germany electricity market is quite competitive with some main market players with private capital. Some German companies grew into international big corporations with generation capacities all over the world, and also in Russian Federation.	E.ON <sup>2</sup> – private, one of the biggest German companies, involving into renewable energy projects with more than 72 000 employees all over the world and 750 KWh sales electricity. EnBW <sup>3</sup> – majority of company owned by state, have more than 5.5 customers, dealing with generation electricity.	Low

<sup>1</sup> <http://www.hpi.com.cn/sites/english/Pages/Organisation.aspx>.

<sup>2</sup> <http://www.eon.com/de.html>.

<sup>3</sup> <http://www.enbw.com/index-2.html>.

Table 1 (cont.). Electricity market and electric utilities in different countries

№	Country	Electricity market	Companies included in research	Regulation
3.	Europe/France	In France more that a half electricity is generated on nuclear energy. So for providing energy safety government control and regulate all processes in producing, transmitting and distributing electricity.	Schneider <sup>1</sup> – private, world leader in electricity distribution, have a lot of offices all over the world.	Quite high
4	USA	Restructuring process in electricity sector in Russia passed on relatively the same scenario like US had. The difference was only that in Russia restructuring process was made on federal level and at the same time in US restructuring was made only in several States.	Xcel Energy, PublicServiceEnterprise, Entergy, Consolidated Edison, First Energy and PPL all are private companies generating electricity and distributing it in different state. Their activity is regulated by state where they sell electricity.	Low

Table 2. Number of clusters for electric utilities during 2002-2012 (based on Kohonen's Map method)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Rushydro (Russia)	1	2	1	3	2	1	1	7	6	7	7
Huaneng (China)	2	1	2	1	3	3	2	6	7	6	6
EnBW (Germany)	5	6	5	5	1	6	6	2	2	1	2
E.On(Germany)	6	5	7	6	7	5	5	3	3	1	2
Schneider (France)	6	5	7	6	7	5	5	3	3	1	2
Xcel Energy (USA)	4	3	4	2	4	2	4	6	5	5	4
PublicServiceEnterprise(USA)	4	3	4	2	4	2	4	4	5	5	4
Consolidated Edison (USA)	3	4	3	4	5	7	4	5	4	4	5
FirstEnergy (USA)	3	4	3	4	1	4	4	5	4	4	5
Entergy (USA)	6	6	5	4	5	7	7	2	2	3	3
PPL (USA)	7	7	6	7	6	4	6	1	1	2	1

Table 3. Average rate of factors in different clusters for 2012

	1 <sup>st</sup> cluster	2 <sup>nd</sup> cluster	3 <sup>rd</sup> cluster	4 <sup>th</sup> cluster	5 <sup>th</sup> cluster	6 <sup>th</sup> cluster	7 <sup>th</sup> cluster
Return on equity (ROE)	0.145	0.0775	0.094	0.1101	0.077	0.084	-0.042
Return on sales (ROS)	0.124	0.0394	0.084	0.1099	0.072	0.041	-0.077
Return on invested capital (ROIC)	0.063	0.0504	0.036	0.0541	0.041	0.061	-0.026
Networking capital (NWC)	1.131	1.505	1.086	1.1155	1.096	1.162	1.289
Fixed assets to current assets	7.61	2.0116	10.73	9.0311	11.66	6.18	3.4599
Assets turnover	0.282	0.7088	0.238	0.3168	0.3	0.514	0.3451
Current ratio	0.901	1.3207	0.897	0.9591	0.685	0.386	0.981
Quick ratio	0.16	0.3156	0.13	0.0642	0.061	0.115	0.2038
Inventory turnover	55.93	71.256	126.6	71.015	38.92	22.11	19.12
Net receivables turnover	49.94	66.482	35.49	50.696	49.03	41.9	37.53
Net payables turnover	104	101.02	134.9	102.84	100.5	88.71	64.54
Operations turnover	105.9	107.26	162.1	121.71	87.95	66.25	60.25
Financial turnover	1.822	19.256	27.2	18.866	-12.6	0.526	1.569

<sup>1</sup> <http://www.schneider-electric.com/site/home/index.cfm/ww/?selectCountry=true>.