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Influence of Composition of Power Plant Fleets and Ownership of Transmission and Distribution Networks to Incumbent Company's Business Success in Some Former Socialist EU Countries

SUMMARY

By joining the EU, companies from eastern countries, which until then had largely operated in regulated circumstances, had to adapt to the open market. Liberalization and deregulation were imposed on them as new mantras, in contrast to ensuring the supply at all costs and addressing social issues. How these companies flourished in new circumstances is a legitimate topic for managerial research. This article researches the impact of the »hard assets« composition, that those companies operated, on their expected business success after a multi-year adjustment period. Positivistic research philosophy, »case study«, and the deduction approach are used. The data were collected mainly from secondary sources. 3 research goals were selected with 3 relevant research questions. An attempt was made to respond to them on the example of 7 Central European countries and 11 companies, direct successors of original incumbents. The property is grouped into 3 groups: classical power plants (nuclear, hydro, coal), renewable power plants (wind, solar, bio mass) and lines (transmission and distribution). Criteria for success are selected according to usual praxis, but also adjusted to accessible data, predominantly from the company's annual financial statements. Contrary to the developed intuition, and based on cases of companies analyzed, there was no significant correlation between the selected criteria of success and the observed asset classes, serving as independent variables. The biggest problem in the research was access to data. This paper is an extraction from an MBA dissertation.

KEY WORDS

assets valuation, success prediction, incumbents, deregulation, liberalisation

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1. INTRODUCTION

There are different business strategies which companies use to grow business or profitability, one of them being internationalisation. Once many middle and eastern European countries opened their borders to the west, they encountered new competition. Western companies in their pursuit of internationalisation strategy, operating in many different fields of activity, felt the sudden business "vacuum" of the east, a myriad of unsatisfied consumer needs offering opportunities. For sure they had more money, more knowledge and much more experience in the competitive environment, as eastern companies were mostly used to operate in regulated circumstances. The power of the eastern competitors was here perceived as weaker and markets as prone to entering.

How the companies originating from the east coped with the new situation, is for sure an interesting subject for research in managerial or strategic fields. When it comes to energy business in this context, and more specifically electricity business, it has its particularities. Energy is a "condition sine qua non" for modern society. The same is true for electricity. It is essentiality different to some other goods/products such as certain type of shoes or bananas, which come from a variety of sources and have a much higher demand price elasticity. The value of the GDP lost, if there is a reduction of supply, is couple of hundred times more than the price of the same amount of electricity. Another reason for the special status of electricity is the size and complexity of its infrastructure. Electricity systems, comprising of generation, transmission and distribution systems, are the biggest systems in the world, spreading across continents, built through decades, necessarily interconnected to politics in many ways. Clearly these systems are too big and too important to fail for any country. However, is it out of the question that some specific company operating in some or more parts of electricity value chain in one country fails totally or diminishes substantially? Would the politics or some other factors find a way to "intervene" and help a seemingly irreplaceable domestic energy subject which found itself in troubled waters? Would national governments take a role of an observant bystander and let the markets play their role as it is intended by the market economy paradigm where decisions are made based on price signals? Finally, are there some already recognisable patterns in the structure of the "eastern companies" that can lead to a prediction of their future success?

These and similar question are relevant. As the electricity business is long established and quite old, not much organic growth is happening in Europe. Energy efficiency is generally politically promoted, lately even more so as there is a universal recognition of the greenhouse effect danger. Consumption is mostly stagnant and for (former) western companies, push to the east was and still is a logical move.

Latest example where one can observe the development in the electricity market after its deregulation and liberalisation is Croatia. Here, an interesting phenomenon occurred recently in the retail business. Namely, after the initial entry of numerous new electricity retail companies, the market is lately getting more and more consolidated and the number of players is declining (Bičak 2018). It is a counterintuitive situation since one would expect that once markets open to competition, more and more players will emerge. By early 2018, HEP practically succeeded in surviving in the open markets, now for more than 5 years, against many challengers. It also succeeded in keeping more than 90% of the retail market for itself, not to mention the generation market where its position is unchallenged. Consequently, this also means that most of the early entrants into the Croatian electricity market failed.

So, which characteristics of HEP and the Croatian market are the ones relevant for this outcome? How did HEP manage to keep a high percentage of the market against private or international competition? Is it possible to define these characteristics and use them to compare HEP to other incumbents that found themselves in similar situation as HEP, after the market opening when their countries entered the European Union? Clearly, the situation in Croatia is not unique, as other countries also went through the same process of negotiations before entering the EU, with implementation of the EU legislative, deregulation in energy business being a part of the process. An attempt to find a western company with similar success was made, resulting in identifying SSE (Scottish and Southern Electric). SSE was practically the only continuously profitable energy company among the "big 6" in the UK in the 2009-2012 period. One of the theories explaining the good SSE performance was that it is inherently difficult to manage all parts of the production-transmission-distribution-retail chain for electricity and energy, and ownership of all parts helps in achieving better results, whatever the underlying root cause of this may be. SSE clearly states in its annual report (SSE p.l.c. 2012, p.31) that "*customers benefit from lower exposure to wholesale price volatility and from price stability through "smoothing""*. This general difficulty of management can be viewed maybe as a natural characteristic or a problem of the electrical system, originating from its complexity. If this is accepted as such, than the vertical integration of some portions or all of business can be considered as a „cure" or solution.

Yet, on the example of electricity market in Sweden (Tang 2018), it was discovered that "*multi-plant firms on average have one percentage-point lower return on total assets, than single – plant counterparts*" implying that additional complexities, in this particular market, bring additional costs.

The other feature describing electricity infrastructure is its costs. For example HEP owns more than 2000 MW of hydro power stations, as well as 50% of the Krško nuclear power plant. HEP also owns all the transmission and distribution lines in the country. The best locations for hydro power plants are always built first meaning that every new location is on average less and less advantageous. Nuclear power plants are very difficult to build because of huge costs and also NIMBY phenomenon. These types of power plants, once built, have relatively low operating costs. They bring in a lot of profits.

Unlike hydro, nuclear or suitable lignite power plants, the ownership of wind, solar as well as gas power stations does not fall into this „difficult to get or develop" category, as the barriers to entry for these electricity sources are substantially lower. Thus, it is not such an enduring competitive advantage for anyone to operate a gas fired power station with its investment costs of less than 1000 Euro/kW.

Finally, the important factor describing and distinguishing between different electrical industries infrastructure is whether the assets, or combination of assets, is easy to replicate for companies coming late into a market. HEP has a very similar combination of hard to replicate, expensive hard assets related to electricity, present in the whole electricity value chain, same as SSE. The question to consider is whether this composition of factors is relevant for HEP's success, and an attempt of answering this can be made for similar eastern countries, which had their own incumbents upon entring the EU.

1.1 AIMS, OBJECTIVES AND QUESTIONS

After describing the context and some possible factors explaining the future performance of incumbents, it is necessary to define the research question. First, a choice of the countries to be observed needs to be made. The chosen countries are: **Croatia, Poland, Czech Republic, Slovakia, Hungary, Bulgaria and Romania**. These 7 countries have a similar "energy past". The timing of entrance into the EU being similar. Following upper discusion, the aim of this study is to: analyse common characteristics behind the performance of incumbent electricity companies in seven designated countries, with a special focus on ownership structure of power plants and lines.

Furthermore, this general aim is broken down into three more specific objectives. These objectives are directly translated further into research questions, shown in table I.

Table I. Research objectives and questions

Research Objectives	Research Questions
To evaluate if the ownership of hydro power plants, nuclear power plants, lignite/coal power plants by incumbent companies, can influence future success of these companies, observed on the example of the last 10 years	Q1: Can the ownership of hydro power plants, nuclear power plants and lignite/coal power plants by incumbent companies influence the future success of these companies, observed on the example of the last 10 years?
To evaluate if the ownership of „new" renewables or development of „new" renewables such as wind, solar and bio mass by incumbent companies, can influence future success of these companies, observed on the example of the last 10 years	Q2: Can the ownership of „new" renewables or development of „new" renewables such as wind, solar and bio mass by incumbent companies influence the future success of these companies, observed on the example of the last 10 years?
To evaluate if the ownership of transmission and distribution networks by incumbent companies can influence future success of these companies, observed on the example of the last 10 years	Q3: Can the ownership of transmission and distribution networks by incumbent companies influence the future success of these companies, observed on the example of the last 10 years?

Source: author

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1.2 RATIONALE FOR THE STUDY – WHO CAN BENEFIT FROM IT

This research deals with the assessment of the influence of the combination of hard assets for some companies to the future success they will eventually have in the market. It is important to the management of these companies, as it will help them understand some part of the value adding process. It has its meaning to the existing competitor companies and potential competitors as well. It also has merit for policymakers, regulators and different energy agencies. In this regard, it can be considered as „integrated research and consultancy project" for incumbent companies, possible new entrants and other subjects mentioned. If found that possession of some combination of hard assets benefits the business performance of a company, it would be an example of a rather rare strategic situation, as, *„it is unusual for competitive advantage to be explainable by differences in tangible resources of organizations, since over time they can usually be imitated or traded*" (Johnson, Scholes and Whittington 2005, p.103).

An addition to the theoretical knowledge can be expected e.g. in the context of 5 forces, as described by Porter. The 5 forces are: Supplier power, buyer power, threat of new entry, threat of substitution, competitive rivalries (Johnson, Scholes and Whittington, 2005). The results of this research can clearly bring an additional insight in electricity markets after deregulation, providing new insight particularly for the force of "threat of new entry".

For the purposes of refining the research question, checking its initial validity, and better understanding the research rationale, literature review must be done. The goal of the literature review is shortly to "*map and assess the existing intellectual territory*" (Saunders, Lewis and Thornhill 2009, p.60).

1.3 SHORT DESCRIPTION OF THE RESEARCH APPROACH

The chosen research philosophy is positivism. Positivist approach "*adopts the stance of the natural scientist*" where the end product of the research can be "*law-like generalisation similar to those produced by physical or natural scientist*" (Saunders, Lewis and Thornhill 2009, p.113). Collection of data and quantitative analysis relate to this choice.

The chosen research approach is deduction, having "*its origins in research in natural sciences*" (Saunders 2009, p.126). The purpose of the research is to be descriptive and even more explanatory. The research strategy is "case study", as it provides "*rich understanding of the context of the research*" by Morris and Wood from 1991, as cited by (Saunders, Lewis and Thornhill 2009, p.146). The case study strategy also has the ability to provide answers to "why", "how" and "what" questions, which is a purpose of the research. Both qualitative (e.g. reading the scientific literature, examining secondary and tertiary documents) and quantitative methods (using sheet balances for analysis of success criteria for incumbent companies) will be used for data collection and data analysis. This can be referred to as "*mixed-model research*" as described by (Saunders 2009, p.183). Originally planned as longitudinal, time horizon of the study changed to end also as a "snapshot" or "cross–sectional" which was added during the course of the study. So, average phenomena in the chosen time period were observed but additionally also in the last available year so as to be able to compare the two.

2 LITERATURE REVIEW

2.1 INTRODUCTION

The role of the literature review is to find out what is already known on some subject. It is necessary to acquire the *„awareness of the current state of knowledge on a subject, limitations, and how one research fits into a wider context*" (Saunders 2009, p.59), raising also subjective knowledge in the process. Unlike in academic discipline, *„business and managerial research makes use of wide range of literature*" (Saunders 2009, p.61). This wide screening was used for current research as well. Introductory reading was done on SSE in an attempt to find a possible source of its success. From stated sources, it would appear that SSE's ownership of tangible, hard to replicate power infrastructure was exactly the cause (among others) which helped it achieve good business results. Interesting to note, similar factors exist in the case of HEP, which eventually lead to the final research question. RWE, another electricity company active in more parts of the electricity chain, was also analysed thoroughly, as it, contrary to SSE, operates in Middle European countries, a part of the former eastern bloc. What was observed here was the fact that it was very difficult for RWE to differentiate from other companies in the energy markets. There exists a condition of inertia among customers, with brands *„that are little more than labels on otherwise near-identical service*"(Beech 2016). Clearly, it was difficult for new entrants to differentiate in all new markets as well, and eventually, many of the biggest independents went broke in e.g. Germany, similar to Croatian condition today.

2.2 DEREGULATION AND LIBERALISATION

Until a couple of decades ago, *„the entire electricity sector in Europe was organized as a state-owned and controlled monopoly*" and in every country there was one *„vertically integrated company*", *„responsible for the generation, transmission, distribution and supply of electricity*" – an incumbent (Beus at al. 2018). In 1996 with the first EU directive on electricity, electricity sector started to open or deregulate. The goal of this process was to *„enable competition through restructuring of the entire power sector*" (Đogić 2018, p.79), as deregulation originated from the idea that *„public companies do not have proper incentives to optimize and reduce their costs*" (Đogić 2018, p.80). As eastern bloc disintegrated in early 90's, former Warsaw pact countries, among others, started entering the EU from 2004 until 2013.

By (Schneider & Jaeger 2001), electricity sector liberalisation is part of the wider trend toward liberalisation and the withdrawal of the state from involvement in infrastructure industries. Namely, up until the last quarter of the 20th century, most of them were governed by monopolistic structures tightly controlled by the state (Schneider & Jaeger 2001, p.4). By many observers, this reduction of the role of the state in infrastructure, is a part of an even wider trend, a *„manifestation of the process of globalization and its negative effects on the erosion of state sovereignty*" (Schneider & Jaeger 2001, p.4). Regulation originally was imposed by state, trying to reduce negative economic effects such as: child labour, monopolies, pollution, excessive working hours, frauds etc. Usual consequences of excessive regulation were not something that would fit well with the concept of „perfect competition", traditionally described as:

> "*they are made up of a very large number of firms, each with negligible proportion of the market;*
> *industry products are perfectly homogenous;*
> *entry and exit from the industry are totally unimpeded*"
>
> (Bailey & Baumol 1984).

Deregulation wave starting in the 70's spanned different industries in different entities, but usually was confined to: Airline or transportation in general, gas and electricity, telecom, financial, post and similar. The process did not progress without on-going controversy, also for electricity industry. So, according to (Beder 2003) "*Electricity deregulation was supposed to bring cheaper electricity prices and more choice of suppliers to householders*". Instead it has brought "*wildly volatile wholesale prices and undermined the reliability of the electricity supply*" (Beder 2003).

One of the proclaimed goals of liberalisation is *„to increase the market size*", and to establish *„the perfect competition in the market, where the most efficient producers have the largest market share*" (Đogić 2018). Benefits are then *„passed on to customers and the economy in the form of lower price and costs*" (Jamasb & Pollitt 2005).

Expected consequences of liberalisation were: reduction in electricity price, improvement in the level of service, reduction in the price differences among countries, the option for each customer to choose a supplier, and an increase in the efficiency of the sector by reducing the need for the construction and maintenance of reserve capacities (Tominov 2008). These are the „pros" of the liberalisation.

At present, current EU electricity market liberalisation represents *„the world's most extensive cross jurisdiction reform of the electricity sector involving integration of distinct state-level or national electricity markets*" (Jamasb & Pollitt 2005). It is centrally driven by the European Commission, with the long term objective of *„a single European energy market*" (Jamasb & Pollitt 2005). Without this support, the reform *„would have been considerably slower*" (Jamasb & Pollitt 2005). Namely, after electricity crisis in California in 2000-2001, *„restructuring process has slowed down significantly and many states have put their reform plans on hold*" (Jamasb & Pollitt 2005). It was observed that the consequences of blackouts were quite severe, which was a materialisation of a worst case scenario, an example of the „cons" of liberalisation. The original intention of the introduction of the „cost-of-service model of regulation" in 1920's was exactly an insurance against *„market manipulation, volatile prices and outages in exchange for a relatively small penalty in inefficiency*" (Duane 2002).

The role of incumbents' market power and its deterrent role to new entrants is recognised and also analysed, e.g. in banking industry. One of the examples is Italian banking market after opening. The experiences observed seem to be relevant for some other industries as well.

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The existence of a „*relatively small potential up-side benefit in the form of moderately reduced rates and improved efficiency at the risk of huge downside costs and decreased reliability*“ coming from deregulation, (Duane 2002) is only one of the specifics of the electricity system and challenges for the deregulation process. The other are the physical characteristics of the system.

Three most distinguished features describing electricity system are:

- Huge sunk costs connected to physical infrastructure and corresponding functions: power plants-generation, lines-transport and distribution, connections to consumers - sales;
- Necessity of vertical integration of the indicated functions, with each function having „different economies of scale“;
- Synchronicity of the physical phenomena in the system. The storage of electricity is still practically not possible on the large scale even lately, so the balance between production and consumption needs to be preserved in all nods all the time (Jamasb & Pollitt 2005).

2.3 LIBERALISATION AND DEREGULATION OF ELECTRICITY SECTOR IN CEE COUNTRIES

Generally, despite formal liberalisation of the electricity market, „*changes in the power sector in many European countries were rather slow*“ (Đogić 2018). In regard to former eastern countries, there are some specifics. By (Đogić 2018) it is recognised that the process of adaptation for new countries remains far more difficult for electricity utilities, as there is a significant negative legacy. The first difference is that electricity was mostly traded as a commodity, which needed to be available to „*all customers regardless of the price*“ (Đogić 2018). The result was that the prices were very low, leaving utilities without investment potential. The development was nevertheless pursued through various types of state intervention. Other difficulties were “*surplus of employees with low efficiency, lack of managerial skills and inferiority of economic development of the related countries*“ (Tominov 2008).

After deregulation, incumbent utilities „*wanted to retain their market share*“ and „*exploit their positions of formerly vertically integrated state-owned monopolies as well as their connections to the governments and regulators in order to influence market entry and secure their positions*“ (Đogić 2018). It considering indicators such as ability of customers to switch suppliers, possibility of entrance, absence of excessive concentration of asset ownership, decoupling of transmission and production etc.. It was observed that progress in „*opening networks and markets was slower in SEE compared to others*“ because „*region's utility sectors are burdened with the legacy of inefficiency, underinvestment and a lack of customer focus, all inherited from the former communist regime*“ (The Economist 2010).

2.4 PERFORMANCE INDICATORS FOR COMPANIES IN ELECTRICITY INDUSTRY

The debate on objectivity of company's performance measurements is extensive and on-going. According to (Leković & Marić 2015), for big companies, with publicly accessible financial statements, this theoretical aspect is somewhat neglected, and success is expressed via means of „*financial indicators, as the total income per employee, profit per employee or the period to return investment, etc.* “. For objective measures, this is not surprising and it is also expected, as e.g. by (Novak & Sajter 2005), „*financial ratio analysis is the alphabet of the economic analysis of enterprises*“. Out of five **profitability ratios** mentioned by (Loth 2018), for the sake of simplicity and focus of the study, only Profit Margin and Return on Assets are used. **Efficiency ratios** described by (Loth 2018) are: Fixed-Asset Turnover, Sales/Revenue Per Employee, Operating Cycle, of which the first two are chosen. With the „fixed asset turnover“ the choice is made to use total assets for the calculation. The other possibility would be to use strictly „fixed assets“, also known as „capital assets or property, plant, and equipment“ (Loth 2018).

The chosen 4 ratios for incumbents are investigated for the last 10 years from all the possible sources, starting from aggregate sites. Then they will be brought into correlation with hard assets.

2.5 ASSET VALUATION

During research it proved difficult to establish market or even book value of some power equipment. In praxis, the regulatory book value of an asset has little to do with its economic value. As some companies provide only for total asset value, it is not possible to distinguish between value of assets in generators or lines. For the purpose of this research, this is yet necessary. For the purpose of replacement-cost valuation, it is necessary to have a recent source, on investment costs related to European electricity market. An attempt to find such values was successful with identification of Levelized Cost of Electricity Issue 2015 (VGB Powertech 2015), where typical values for power equipment costs for the year 2015 were provided, which was used.

3. METHODOLOGY

Research philosophy is a general term describing “*the development of knowledge and the nature of that knowledge*” (Saunders 2009, p.107). Here, positivism, “*working in a tradition of natural scientist*” is chosen as the philosophical concept. The research strategy is generally a plan of “*how the researcher will go about answering the research question(s)*” (Saunders 2009, p.600). Here, the research strategy will be a case study. Case study namely helps in: ”*understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research*” (Yin 1994, p.23). Research approach is a general term used for “*inductive or deductive research approach*” (Saunders 2009, p.600). Here, deductive approach was chosen.

Primary data is defined as “*data collected specifically for the research project being undertaken*” (Saunders 2009, p.598), while secondary data is originally collected for some other purpose. Because of the longitudinal aspect of the study, collecting primary data would not be feasible. Most data will be extracted from secondary and tertiary sources available on line, an example beeing annual reports. When it comes to the question of qualitative and quantitative analysis both will be used. Clearly an attempt will be made to use quantitative parameters for the description of “business success”, mostly from company's yearly financial statements, or sites that aggregate such data. Qualitative analysis is needed for incumbents' identification. Upon obtaining data from various sources, they were all put into an excel table. Different tables were produced based on this excel data and an attempt to find correlations was undertaken. In parallel, data were shown drawn on diagrams, so as to visually establish correlations. Mathematically, two kinds of correlations were analysed: Pearson's and Spearman's. As no sample was used, there was no need for sample analysis techniques. Among others, because of a relatively small number of companies, sensitivity analysis was performed by including/excluding some of incumbents.

4. FINDINGS/RESULTS

4.1 Incumbents – identification

Identification of incumbent companies was not straightforward. As an explanation of the rationale for the choice performed, a reminder of basic physical and economic logic of electricity is needed. There are 4 different lines of business. If one covers generation, transmission, distribution and sales in one country, all mayor parts of electricity chain are covered. Clearly, this division, description and scope are not perfect and total. There are other functions in each company, like economical, HR, telecommunications, informatics and many others. For sure in the 7 countries, some of these functions were split forming new, different companies, but such companies, although incumbents, although maybe operating in some parts in electricity business, are not the subject of this research. In some countries regulators also originated from incumbents, they keep working in electricity business, but such companies were also not persued. Even an attempt to identify them was not tried. Eventually, after rejecting also e.g. single power plant companies, single business companies etc.., 11 companies were identified: BEH, CEZ, HEP, MVM, Enea, Energa, PGE, Tauron, Electrica, Hidroelectrica and Slovenske elektrane.

4.2 BASIC DESCRIPTION OF SELECTED COMPANIES

The highest level description of individual incumbents is performed by grouping them by number of businesses they operate in. For this purpose they are shown split into 3 groups, by scope of integration of different core electricity businesses.

Only in Croatia is the situation very similar to the one before deregulation. The company HEP still owns all 4 electricity businesses, (generation, transmission, distribution and retail). The next group is the one where one of the businesses is missing from company's portfolio, typically transmission.

Table II.: Incumbents with 3 businesses

Country	Poland				Bulgaria	Hungary	Czech Republic
Company	PGE	Tauron	Enea	Energa	BEH	MVM	Cez
Functions	Production	Production	Production	Production	Production	Production	Production
	Distribution	Distribution	Distribution	Distribution	Transmission	Transmission	Distribution
	Retail	Retail	Retail	Retail	Retail	Retail	Retail

The last group of incumbents is the one that went through most changes. In Slovakia, Slovenske Elektrane does not possess any networks anymore. In Romania, the situation is the most complicated.

Table III. Incumbents with 2 businesses

Country	Slovakia	Romania	
Company	Slovenske Elektrane	Electrica	Hidroelectrica SA
Functions	Production	Distribution	Production, Hydro
	retail	retail	retail

4.3 INCUMBENTS – CAPACITIES, GENERATION AND GRIDS

After incumbents' identification, short description and grouping, next step in answering research question is identification of incumbent's assets in the area of generation capacities and networks. In table IV incumbents' power plants and networks are shown:

Table IV. Incumbents' assets

		HEP	ČEZ	PGE	Tauron	Enea	Energa	Slovenske elektrane	BEH/NEK	Electrica	Hidroelectrica	MVM
Power plants capacity installed (MW)	Nuclear	348	4290	0	0	0	0	1940	2000	0	0	2000
	Hydro	2.115	1985	1600	18	58	365	1653	2713	0	6444	0
	Coal/lignite	330	7754	10890	4572	5910	681	486	1620	0	0	0
	Wind	0	770	529	72	70	211	0	0	0	0	23
	Solar	0	125,1	1	1	0	5	2	0	0	0	0
	Biomass	4	30	69	237	159	1	0	0	0	0	0
Total NHC (MW)		2793	14029	12490	4590	5968	1046	4079	6333	0	6444	2000
Total WSB (MW)		4	925	599	310	229	217	2	0	0	0	23
Total company (MW)		4385	15720	12750	5574	6200	1340	5739	6333		6444	2023
Total Country (MW)		4878	21989	38104	38104	38104	38104	7742	10739	23580	23580	8750
Company generation 2016 (TWh)		12,5	61,1	53,7	16,8	13,6	4,0	19,0	n.a.	0	n.a.	16,4
Country generation 2016 (TWh)		12,8	83,3	166,6	166,6	166,6	166,6	27,1	45,3	65,1	65,1	31,9
Grid (1oookm)	HV grid (km)	7.69	9.85	0	0	0	0	0	15.1	0	0	4.84
	M&LV grid (km)	140	154	288	258	122	185	0	0	117	0	0
Percentage of generation (%)	NHC	64	89	98	82	96	79	71	100	0	100	99
	WSB	0,1	5,9	4,7	5,6	7,2	16,2	0	0	0	0	1,1

Source: author, based on Annual reports, corporate web pages, European Commission

Power plants are aggregated into 2 groups, so as to correspond to research questions. The first one is „NHC" group, consisting of nuclear, hydro and coal. The second is wind, solar, biomass, designated as „WSB". Third is lines. Corresponding values are shown in table V. An example of calculated values for one research question is shown in table VI. Success criteria are shown as well in figure 1, so as to visualy establish correlation.

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Table V. Non-depreciated average asset class values for incumbents

	HEP	ČEZ	PGE	Tauron	Enea	Energa	Slovenske elektrane	BEH/NEK	Electrica	Hidroelectrica	MVM
Nuclear (MW)	348	4290	0	0	0	0	1940	2000	0	0	2000
Hydro (MW)	2.115	1985	1600	18	58	365	1653	2713	0	6444	0
Coal/lignite (MW)	330	7754	10890	4572	5910	681	486	1620	0	0	0
Company's NHC value (10^6 Euro)	9078	35540	21775	6919	9062	2263	14109	19654	0	21909	8000
Wind	0	770	529	72	70	211	0	0	0	0	23
Solar	0	125,1	1	1	0	5	2	0	0	0	0
Biomass	4	30	69	237	159	1	0	0	0	0	0
Company's WSB value (106 Euro)	7	2292	1450	610	461	532	5	0	0	0	58
Company's line value (106 Euro)	2770	3100	4030	3610	1710	2590	0	1590	1630	0	508
Company's 2016 total assets book value	5190	23347	15290	7560	5560	4243	9490	8804	1850	4150	4650
NHC value/Asset ratio (%)	175	152	142	92	163	53	149	223	0	528	172
WBS valus/asset ratio (%)	0,13	9,81	9,48	8,07	8,29	12,54	0,05	0	0	0	1,25
Line value/asset ratio (%)	53,4	13,3	26,4	47,8	30,8	61,0	0	0	88,1	0	10,9

Source: author, based on Annual reports 2007-2017 of 11 companies

Table VI. Companies by NHC value/asset ratio, average success criteria

	Hidroelectrica	BEH	HEP	MVM	Enea	ČEZ	Slovenske elektrane	PGE	Tauron	Energa	Electrica
NHC value/Asset ratio (%)	528	223	175	172	163	152	149	142	92	53	0
Profit margin (%)	10,8	0,5	6,9	6,0	7,4	17,5	11,1	12,2	3,8	4,7	5,8
ROA (%)	1,9	0,2	2,7	3,8	4,2	7,0	3,7	5,5	2,4	3,3	3,8
Asset turnover	0,15	0,40	0,38	0,69	0,56	0,38	0,32	0,44	0,61	0,67	0,64
Trunover/ Employee (1000 Euro)	155	129	145	318	200	264	512	145	155	235	108

Source: based on Annual reports 2007-2017 of 11 companies

4.5 ASSESSMENT OF CORRELATIONS

To assess correlation between NHC, WBS and line values to 4 success indicators, corelations using excell were calculated. Correlation coefficient enables to „*quantify the strength of linear relationship between two ranked or numerical variables*" (Saunders 2009, p.459), only an example is given in Figure 1.

$$Correl(X,Y) = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sqrt{\sum (x-\bar{x})^2 \sum (y-\bar{y})^2}} \quad (1)$$

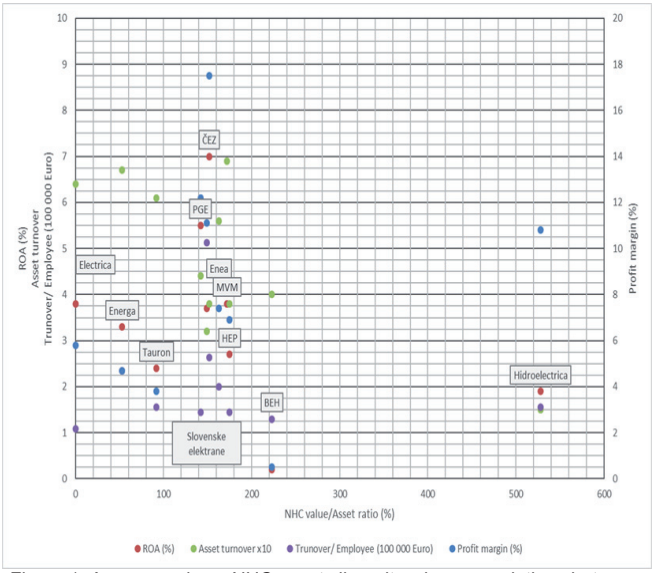

Figure 1. Average values, NHC assets linearity, shows corelations between parameters.

5. CONCLUSIONS

The first research question was: "can the ownership of hydro power plants, nuclear power plants, lignite/coal power plants by incumbent companies influence the future success of these companies, observed on the example of the last 10 years".

To try to summarise the answer to the first question: It seems that for the chosen 11 companies, when taking into account even rudimental sensitivity analysis in the described way, by omitting companies without any NHC sources or Hidroelectrica, which is more than 2 sigma away from the nearest other entry, there is no possibility to predict success of the companies observed through the chosen 4 success criteria, related to NHC value/asset ratio. The only clear, not changing correlation is the negative correlation of the NHC value/asset ratio to asset turnover. The interpretation of this is that with rising percentage of NHC assets, it gets more and more difficult to turn around assets.

The second research question was: "Can the ownership of "new" renewables or development of "new" renewables such as wind, solar and bio mass (WBS) by incumbent companies, influence the future success of these companies, observed on the example of the last 10 years".

As a conclusion to the second question: As the percentage of WBS sources was found to be rather low, in comparison to total assets, all conclusions must be taken with caution. More than a half of the observed companies have less than 1% of their total assets in such sources. If one takes average values, for the 2007-2017 period, most success criteria have positive correlations. The more WBS the company has, the higher the average success. But this fact changes lately. In 2016, most correlations are getting negative, meaning that success related to the same input diminishes with time. There is one exception. Turnover/Employee is negative in all cases, meaning that the higher percentage of WBS assets, the lover Turnover/ Employee gets.

The question 3 was: "Can the ownership of transmission and distribution networks by incumbent companies influence the future success of these companies, observed on the example of the last 10 years".

Krešimir Komljenović, Influence of Composition of Power Plant Fleets and Ownership of Transmission and Distribution Networks to Incumbent Company's Business Success in Some Former Socialist EU Countries, Journal of Energy, vol. 70 Number 1 (2021), p. 29–35
https://doi.org/10.37798/202170156

Possession of lines had a negative correlation to profitability, but recently picture somewhat changed towards rising profit ratios. The same is true for ROA. Asset turnover is positive, but Turnover/Employee clearly negative.

Additionally, taking into account all stated considerations, it seems that no conclusions on success can be drawn based on division of incumbent companies according to number of main electricity businesses they operate.

Finaly, it can be observed that profit margin is negatively correlated to year of entry. The longer the company is in the EU, the lower the profit gets. ROA also falls during time. Asset turnover falls, meaning that the longer the company operates in the EU, the higher the asset turnover gets. Finally, there is a clear sign that the longer the company operates in the EU, the less employees it needs to earn the same amount of money.

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