PROJECT FINANCING IN THE HUNGARIAN ENERGY INDUSTRY

The effect of the mandatory off-take system in Hungarian small power plant development[1]

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The research explores developments in the project financing of small power plant investments, ubiquitous in the Hungarian energy sector. After national legislation was amended considerably in 2010, the economic press devoted much attention to the mandatory take-off system and the situation of small power plants using ground-coupled heat pump (GCHP) technology; however, no specific analysis of these operators has been performed to date. The objective of this paper is to present and analyse the changes in the market and its financing, and to draw conclusions for operators, financiers and investors, as well as the regulatory authorities.

JEL codes: G32, G38, L94

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1. GCHP SMALL POWER PLANT PROJECT

The business model of GCHP power plants[2] is a perfect example of highly-leveraged financing and, in particular, the development of project financing structures. The implementation of dozens of such small projects convincingly proved the concept of project financing in this segment. The criteria – and risks – characteristic of this type of financing are invariably met. This paper does not explore in detail highly-leveraged, structured project financing and its players,[3] but rather, it presents certain aspects of it in the context of small power plant projects and related hypotheses.

At the same time, it is necessary to briefly present the structure of small power plant projects[4] by way of an introduction, with a view to highlighting the risks and financing structure of these projects and analysing the hypotheses thereof.

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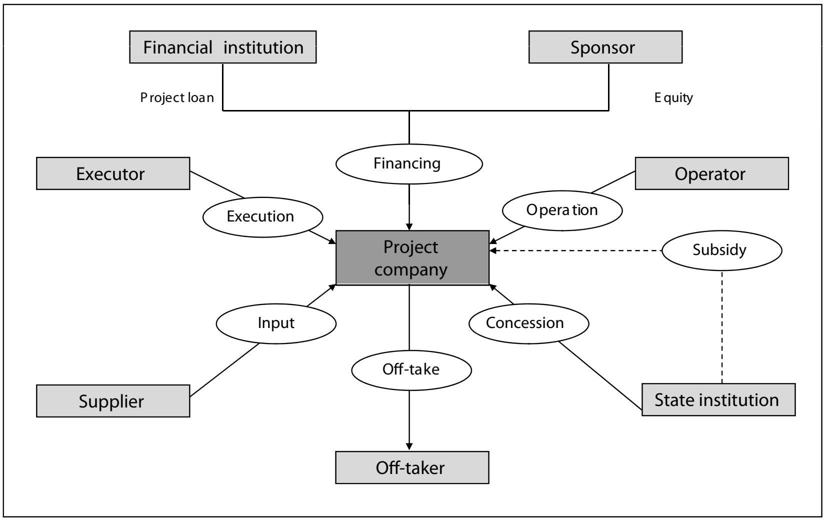
1 This article is a summary of the empirical research results and conclusions of the author's doctoral thesis, defended at the Doctoral School of Budapest Corvinus University in November 2014.

2 GCHP small: gas motor, cogeneration power plant with a capacity of less than 50MW. During the production of energy from gas, it also provides thermal energy that is used for further electrical energy production or supplying heat.

3 For a detailed presentation of highly-leveraged financing and project financing, see Walter (2014a) and Madácsi–Walter (2014).

4 Horváth–Koltai–Nádasdy (2011)

Figure 1
The structure of small power plant projects



It should be pointed out that most of the revenue from these projects and investments comes from selling electrical energy. Accordingly, it has been clear from the outset to all players that, aside from the usual risks (prices), changes in the legislation of the mandatory take-off system[5] posed the greatest risk.

The following sections will examine whether Hungarian GCHP developments were accomplished within the framework of project financing and how changes in legislation affected this market segment and the projects.

2. EMPIRICAL RESEARCH

2.1 Population and sampling

My research primarily focuses on the domestic energy sector, in particular electrical power generation[6]; consequently, the population is represented by all companies that possess domestic power generation capacities. Based on the databases

5 The mandatory take-off system was established for the support of renewable and more effective (gas-operated) electrical energy production which provided for the mandatory take-off of electrical energy produced with an efficiency exceeding 60% by the Hungarian Electricity Company (MVM) or regional electricity providers at a price higher than the market price – Decree 56/2002 of the Ministry of Economy and Transport.

6 Because it is a priority area of project financing (Madácsi–Walter, 2014).

assembled in my research, as of 1 July 2011 there were 21 large power plants[7] and 256 small power plants[8] operating in Hungary. Given that Decree 56/2002 of 29 December 2002 of the Ministry of Economy and Transport was primarily designed to support small power plants through the mandatory off-take system[9] and that the majority of large power plants existed before 2002, I will focus on small power plants in my research.

The 256 small power plants in Hungary can be divided into two categories: renewable energy power plants (using solar, wind, hydro, geothermal, biogas and biomass energy) and gas-fired cogeneration plants. Since Decree 56/2002 of 29 December 2002 of the Ministry of Economy and Transport as amended and effective as of 1 July 2011 excluded small power plants from the mandatory off-take system, my research focuses on GCHP plants. In order to minimise statistical error resulting from sampling, I will seek to analyse the entire population in my research, that is, I will study all GCHP plants that were in operation on 1 July 2011.

2.2 Methods of data collection

Data collection in the research can be divided into two large stages: definition of the population and obtaining financial and other information.

Since in the research I examine the entire population of GCHP plants, as a first step I had to put together that list. However, no similar list has ever been published by MAVIR or the Hungarian Energy Office; therefore, in the primary data collection phase, I had to check the Hungarian Energy Office website to identify, one by one, each GCHP plant that held an operating license on 1 July 2011. The second step was to complete the list by adding the type of technology installed in the GCHP plants – which can be grouped into five categories: combined-cycle gas turbine; gas engine; biogas/biomass; wind energy and solar power. On the above date 256 small power plants were in possession of operating licenses: 4 with a combined-cycle gas turbine (CCGT), 138 with a gas engine, 86 running on biogas/biomass, 22 on wind, and 6 were hydro-power-based small power plants. Given that 142 (4 CCGT and 138 gas engine) small power stations qualify as GCHP small plants, it was this population that was in the focus of my research.

As a next step, I had to examine GCHP companies. The list of GCHP plants reveals that in many cases the same company invested in several GCHP small plants

7 Power plant possessing at least 50 MW built-in capacity.

8 Power plant possessing less than 50 MW built-in capacity.

9 This is a kind of classical indirect state subsidy, since the electrical energy generated by GCHP small power plants had to be bought up by MVM or regional service providers at a price higher than market prices. For direct and indirect state subsidies available to companies, see Walter (2014d).

(the 142 GCHP plants were built by 86 different companies),[10] i.e. these companies constitute the population.

With regard to the hypotheses, I also had to collect financial statements concerning the population. Accounting legislation in force provides that all businesses using double-entry book-keeping are required to publish their annual reports by depositing them with the Court of Registration to be made publicly available at a later stage via the Electronic Reports Portal operated by the Ministry of Public Administration and Justice (KIM). With the help of this website, I have been able to collect the annual reports of GCHP companies for the business years of 2010, 2011 and 2012.

I also needed for my research the given companies' certificates of incorporation, which include the exact date of incorporation, as well as the main parameters of their bank financing, if any. I had access to the certificates of incorporation via KIM's free Company Information Service website and relied on the supplementary annexes to their published annual reports for accurate information about external financing.

2.3 Methodology and hypotheses

Given that the analytical methodology varied for each hypothesis, how the analysis was performed in practice can be described as follows, with an indication of individual hypotheses.

H1: The majority of GCHP small plants still in operation on 1 July 2011 were implemented in a project financing model, since the mandatory off-take system created more favourable conditions for the wider use of project financing in the case of these power plants prior to 1 July 2011. The amendment of the mandatory off-take system of 1 July 2011 is no longer ideal for the project financing model in the context of GCHP plants, and consequently, no new GCHP plants were built after 1 July 2011 using the project financing model.

In this hypothesis I examined how the preconditions of project financing were accomplished in the case of GCHP plants. I also sought to reveal if GCHP small plants still in operation on 1 July 2011 had actually been implemented by way of project financing. For that I needed the date of foundation of the GCHP small plants and the exact date from which external financing, if any, was available for the investment.

10 A company building a GCHP small power plant.

My point of departure in verifying this hypothesis was the practice of domestic commercial banks whereby only companies with closed annual reports for at least two entire years were eligible for bank loans under corporate finance. If, therefore, less than two years passed between incorporation and the use of external financing, the given investment must have been accomplished within the scope of project financing.

Next, I examined how, after 1 July 2011, the conditions of such developments changed, taking into consideration the theoretical preconditions of project financing. I believe that after this date no GCHP small power plant was built with the help of project financing.

In my analysis I had to check, on the website of the Hungarian Energy Office, all operation permits for small power plants issued after 1 July 2011. Next, the founding dates of GCHP companies and the dates of bank borrowings (if any) had to be compared. If less than two years passed between incorporation and the use of external financing, the given investment must have been accomplished within the scope of project financing

H2: The mandatory off-take system, abolished as of 1 July 2011, substantially undermined the monetary position of GCHP companies.

This is perhaps the most complex hypothesis of all, as in this case I looked at the trends of GCHP companies' financial performance by means of their monetary positions previously determined by *Virág–Hajdu–Jávor* (1995). Monetary position is a value established by means of a complex system of indices, which indicates the monetary position of the given enterprise.

I analysed the members of the population with the use of different gearing, liquidity, profitability, turnover rate and cash flow indicators for the years 2010, 2011 and 2012. After calculating the above indicators, I applied principal component analysis and cluster analysis to determine the monetary positions of the GCHP companies. In view of the fact that I performed the analysis for three consecutive years (2010, 2011 and 2012), the study of time series data also revealed changes in the monetary position of the population over the years.

H3: Discontinuation of the mandatory off-take system as of 1 July 2011 led to an impairment of GCHP companies' cash flow generation capacity to such an extent that even called into question their debt repayment capability.

In project financing, the cash flow generation capacity plays a key role, as the EBITDA made by the business provides coverage for the debt service linked to financing. Therefore, as part of the analysis I had to determine the EBITDA values of the businesses concerned and also their debt service. In the EBITDA's case the situation was simple: only the company's operating profit had to be adjusted with annual depreciation. In determining the annual debt service, the supplementary annex to the GCHP company's annual report could be used, more specifically the cash flow statement therein. Determining annual debt service required adding up the annual principal repayment and interest payable.

After that, what I had to examine was how the EBITDA values realised by the companies related to their annual debt service.[11] Since the feed-in tariff system was discontinued as of 1 July 2011, it made sense to look at all three relevant years. That is because while the feed-in tariff system remained unchanged in 2010 and made its effects felt for half a year in 2011, GCHP small plants had to sell the electrical power generated without the feed-in tariff system in 2012.

3. RESEARCH RESULTS

3.1 Hypothesis 1

The analysis of Hypothesis 1 (H1) can be divided into two parts. First, I will look at the conditions in place for project financing prior to 1 July 2011 in the case GCHP plants, and second, I will compare the foundation dates of GCHP companies with the dates of their bank borrowings, if any.

The theoretical preconditions for examining the project financing Hypothesis 1 are as follows:[12]

- *Long-term provision of raw materials required for the project*

  Given the nature of the technology, the primary raw material of GCHP small plants is natural gas. Prior to 1 July 2011, access to natural gas and its price was officially fixed under Decree 96/2003 of the Ministry of Economy and Transport (GKM). Pursuant to the said decree, the regionally competent gas suppliers were not only obliged to supply gas to GCHP plants but also the gas price was determined by GKM.

11 In other words, I had to examine whether the value of the DSCR index (Debt Service Coverage, a standard monetary covenant) was smaller than 1. For the definition of monetary and other standard covenants, see WALTER (2014b).

12 Yescombe (2008).

- *Securing markets for the goods and services produced under the project*[13]

  A GCHP small plant essentially generates electrical power and thermal power. Electricity also used to be subject to administered pricing and compulsory take-off provisions set out in Decree 56/2002 of the Ministry of Economy and Transport. Subject to this decree, locally competent universal suppliers were obliged to take over electricity produced by GCHP plants at a fixed price. This price was adjusted annually by the CPI (with a weighting of 40%) published by the Central Statistical Office (CSO) and by the official gas price index (with a weighting of 60%). In respect of the sale of thermal energy, the GCHP company had to conclude a separate contract which was not regulated by the competent authority, except in the case of public institutions. Other than that, hot steam generated by GCHP plants was usually purchased by the locally competent district heating company – at a price which again was determined by a formula set out in Decree 56/2002.

- *Elimination of risk of budget overrun and late performance*

  GCHP companies usually concluded fixed-price contracts with the contractor building the plant. As a consequence, the set price was only paid after the contactor fulfilled its contractual obligations, and payment would only be reduced by penalty for late performance, if any. That way, cost overruns could be avoided in building GCHP plants.

- Comprehensive feasibility study and financial forecasts

  Given that revenues from electricity and thermal energy sales, as well as gas costs (being the most important cost item) related to GCHP plants were both fixed for the future, it was possible to make sound financial forecasts in relation to the entire term of the GCHP small plant project.[14] Bearing in mind that only minor cost items such as operating and maintenance costs needed to be reckoned with on top of gas costs, financial forecasts had a high degree of reliability.[15]

- *Compliance with regulations and environmental requirements*[16]

  A building permission for a GCHP small plant was only issued after a competent authority had verified compliance with relevant regulatory provisions and environmental requirements. Since the actual financing of the project did

13 Nevitt–Fabozi (1997).

14 Due to the fact that project financing is a form of financing depending on future cash flow production. See Madácsi–Walter (2014) about the conditions of project financing.

15 Although the structure of projects did in fact increase the reliability of analyses, it should be noted that over-optimistic enthusiasm was nevertheless typical. It should be remembered how operators reacted to the prolongation of the mandatory take-off system. For prognostications errors and the related phenomena, see Jáki (2013).

16 Horváth–Koltai–Nádasdy (2011).

not begin until after this procedure, the GCHP small plant investment had met that precondition.

The above list shows that GCHP small plant investments created truly favourable conditions for the spread of project financing. Possibly, however, these invest ments were not accomplished according to this model after all. Consequently, it is necessary to examine the second part of Hypothesis 1.

In the chapter on data collection it was mentioned that 142 GCHP small plant developments were carried out by 86 GCHP companies, so the 86 businesses had to be examined. I compared the foundation dates of GCHP companies and the dates of bank borrowings, if any, In 51 of the 86 GCHP companies, the difference between these dates was less than two years, i.e. these firms were assumed to be project companies. It should also be mentioned that only 7 of the 86 GCHP companies operated without any external financing.

On 1 July 2011 the following preconditions of project financing changed:

- *Long-term provision of raw materials required for the project*

  Since the primary raw material of GCHP power plants is natural gas, it is necessary to examine the relevant 96/2003 GKM Decree. Analysis has revealed that from 2008 onwards, the pricing of natural gas for GCHP power plants increasingly became market-based, after the government decided to chiefly subsidise private consumers. In consequence, the previously applied price formula was no longer relevant, and the price of gas used by the GCHP power plants was primarily determined by demand and supply conditions. Most obviously, GCHP power plants were forced to buy more expensive gas, and they had no way of fixing the price of gas for longer than a year in advance.
- *Securing markets for the goods and services produced under the project*

  The price of thermal energy produced by GCHP small power plants remained unchanged after 1 July 2011, due to the fact that no relevant legislation existed. Decree 56/2002 of the Ministry of Economy and Transport on the regulation of the production of electrical energy, however, ceased to apply to GCHP small power plants, meaning that locally competent universal service providers were no longer obliged to take over thermal energy, and the price of electrical energy was no longer state-subsidised either. In an effort to promote the sale of electrical energy generated by GCHP small power plants, MAVIR Inc. set up a so-called balance circle that integrated all of the affected GCHP companies, and floated the group on the stock market. The backing of MAVIR Inc. was, however, merely technical, and the actual price was established on the electrical energy exchange, which was considerably lower than the price previously established by the mandatory off-take system. On 1 July 2011, for example, the daily average price on the electrical energy exchange was 50% of the price under the mandatory off-take system just a day before. From then onwards, neither the quantity nor the price of the electrical energy could be reliably planned.

- Comprehensive feasibility study and financial forecasts

  Compared to earlier, 1 July 2011 marked the start of considerable changes. Following amendment of Decree 96/2003 of the Ministry of Economy and Transport, GCHP companies could no longer make accurate calculations regarding the cost of gas. Also, the future price of electrical energy was questionable, since GCHP small power plants were no longer governed by Decree 56/2002 of the Ministry of Economy and Transport. Consequently, the previous simple system of financial prediction became a thing of the past in spite of the fact that experts prognosticated rising electrical energy prices.

The above list gives a good idea of how, after 1 July 2011, three crucial theoretical preconditions were impaired in a way that it made project financing a non-option in GCHP small power plant developments in Hungary. Next, I examined whether after the partial impairment of theoretical preconditions any GCHP small power plant were built at all after 1 July 2011, and if there were, whether they employed the project financing model.

After study of the permits issued by the Hungarian Energy Office following the amendment of the mandatory off-take system as of 1 July 2011, it can be established that a total of six GCHP small power plants were built by 30 October 2013. Using the same methodology, I compared the dates of incorporation of the given GCHP companies and the main parameters of their bank financing, if any.

Two of the 6 GCHP companies qualify as large corporations, 2 are GCHP companies that had built GCHP small power plants prior to 1 July 2011, and the remaining 2 are newly-founded companies that have not taken out commercial-bank loans.

That concluded the study of Hypothesis 1 and the hypothesis was confirmed. Based on the foregoing, prior to 1 July 2011 not only were the theoretical premises of project financing fulfilled but also 51 of 86 GCHP companies were considered to be project companies. In other words, nearly 60% of GCHP companies relied on project financing to implement their GCHP small plant developments. Also, it was confirmed that the theoretical preconditions of project financing were partially impaired after 1 July 2011, and no GCHP small power plant was built using the project financing model: none of the newly-built GCHP small power plants were project companies.[17]

17 It is, of course, very difficult to establish the extent to which the decline of project financing was due to the change of preconditions or the change of bank strategies. Clearly, the decline of bank activity, the decline of loaning and the quitting of operators negatively affected this segment, too. For changes in Hungarian banking strategies, see Walter (2014a).

3.2 Hypothesis 2

In examining Hypothesis 2 (H2), I had to determine the monetary position of the GCHP, for which I applied the methodology established by *Virág*, *Hajdu* and *Jávor*.

As a first step, I had to set up a database through the operationalization of the annual reports of the 86 GCHP companies for the years 2010, 2011 and 2012. It was not until after I had populated the database that I came to realise that the annual reports of 6 companies in the population were not available for the year 2012. Consequently, these companies had to be excluded from the sample. Furthermore, on examination of the population I identified 7 large enterprises that had built GCHP small plants in the context of their core businesses; however, the core businesses of these companies is not electric power generation. Given that the inclusion of such large companies would significantly distort the average actual monetary position of GCHP companies, I decided to exclude these firms from the sample as well. As a result, the final sample contains 73 GCHP companies, on which I would test Hypothesis 2.

In the second step, I populated the database with the main items of the balance sheet and income statements for the years of 2010, 2011 and 2012. Next, from the above data I calculated gearing, liquidity, profitability, turnover rate and cash flow indicators used by financial analysis literature. In determining the 13 different indicators I sought to make sure that each indicator was relative and that the higher value meant a more favourable financial position in each case. To this end, I used the inverse value of the original formula of the indicator in 3 cases.

Next, I examined the above indicators in respect of the years 2010, 2011 and 2012. In the case of some of the GCHP companies the denominator had "0" value for three indicators (long-term liabilities, net sales revenues and interest payable and similar charges), and division by "0" is disallowed. Since I had no wish to narrow the sample any further, in these cases I replaced the original "0" with "1" as by doing so the actual value of the given financial indicator was only modified to a very limited degree.

In addition to the above modification, in calculating the return on equity in some cases I was also confronted with negative values both in the numerator and in the denominator where the result was nevertheless a positive number, which would have been misleading in subsequent analysis. I solved the problem by using in these cases the worst RoE value in the given year instead of the original ratios. That way I avoided the problem of losing yet another sample item while I also observing requirements in that a GCHP company that had its own negative equity and disclosed negative results in reality also stood the closest to the worst possible negative RoE value.

Following that, I performed principal component analysis for 2010 with the help of the above 13 financial indicators. Since I had previously classified the financial indicators into 5 groups (gearing, liquidity, profitability, turnover rate and cash flow), in the analysis I sought to identify 5 factors, which was also consistent with the chosen methodology.[18]

The results of principal component analysis performed by the SPSS programme for the year 2010 are as follows:

Table 1

Total variance explained (2010)

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,310	33,154	33,154	4,310	33,154	33,154	2,539	19,527	19,527
2	2,147	16,519	49,674	2,147	16,519	49,674	2,311	17,773	37,300
3	1,782	13,710	63,383	1,782	13,710	63,383	2,200	16,920	54,220
4	1,322	10,170	73,553	1,322	10,170	73,553	2,037	15,667	69,888
5	1,061	8,163	81,716	1,061	8,163	81,716	1,538	11,828	81,716
6	,888	6,833	88,549						
7	,561	4,318	92,867						
8	,477	3,672	96,539						
9	,240	1,846	98,385						
10	,110	,850	99,235						
11	,097	,748	99,983						
12	,002	,017	100,000						
13	9,656E-008	7,428E-007	100,000						

Extraction Method: Principal Component Analysis.

18 Virág–Fiáth–Kristóf–Varsányi (2013)

a

	Component				
	1	2	3	4	5
T1	,245	,069	,826	,025	-,171
T2	,135	,138	,920	,157	-,074
T3	,263	,516	,667	,151	-,046
L1	,836	,081	,203	-,030	-,149
L2	,798	,298	-,025	,135	,061
L3	,851	,185	,197	,085	,012
J1	-,152	-,954	-,145	,049	,092
J2	,070	-,243	-,087	,048	,811
J3	,000	,059	-,120	-,024	,873
F1	-,523	,085	-,242	,026	-,198
F2	,152	,954	,145	-,049	-,092
CF1	,055	-,028	,095	,989	,010
CF2	,054	-,031	,117	,988	,010

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 6 iterations.

The 5 factors identified by means of principal component analysis account for nearly 82% of the dispersion of the 13 financial indicators. Examination of the sets of indicators revealed that the first principal component is of a liquidity type, the second responds sensitively to both profitability and the turnover rate, the third one is a gearing-type indicator group, the fourth one is related to cash flow while the fifth to profitability.

Performing the same principal component analysis for 2011 yields the following results:

Table 2
Total variance explained (2011)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,835	37,196	37,196	4,835	37,196	37,196	3,590	27,616	27,616
2	2,826	21,735	58,931	2,826	21,735	58,931	2,312	17,787	45,403
3	1,300	9,996	68,927	1,300	9,996	68,927	1,819	13,994	59,397
4	1,245	9,579	78,506	1,245	9,579	78,506	1,670	12,850	72,246
5	,751	5,774	84,281	,751	5,774	84,281	1,564	12,034	84,281
6	,690	5,308	89,588						
7	,540	4,153	93,741						
8	,367	2,822	96,563						
9	,245	1,881	98,444						
10	,138	1,058	99,502						
11	,055	,422	99,924						
12	,010	,076	100,000						
13	5,277E-007	4,059E-006	100,000						

Extraction Method: Principal Component Analysis.

a

	Component				
	1	2	3	4	5
T1	,624	,464	,231	,228	-,006
T2	,691	,249	,064	,558	,070
T3	,002	,120	-,021	-,014	,924
L1	-,101	,014	,953	-,004	,005
L2	,021	-,362	,302	,167	,739
L3	-,007	-,149	,722	,414	,233
J1	,937	,230	-,180	-,026	,051
J2	,881	,049	,010	,105	-,084
J3	,348	,003	,026	,830	-,083
F1	,195	,052	-,381	-,636	-,290
F2	-,845	-,355	,232	-,030	-,022
CF1	,216	,955	-,072	,006	-,047
CF2	,371	,878	-,059	-,029	-,039

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 6 iterations.

The above findings suggest that the 5 principal components account for nearly 84% of the dispersion of the 13 financial indicators. Taking a closer look at the 5 principal components we find that they are more difficult to identify than in the case of 2010. The first set of indicators respond sensitively to profitability and the turnover rate, the second one is a cash flow-type group, the third one is of a liquidity type, the fourth group responds to profitability and the turnover rate to almost the same extent, and the fifth indicator group is sensitive to gearing and liquidity.

Continuing the testing of Hypothesis 2, I also carried out principal component analysis for 2012 with the results below:

Table 3
Total variance explained (2012)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3,567	27,441	27,441	3,567	27,441	27,441	2,802	21,556	21,556
2	2,350	18,076	45,516	2,350	18,076	45,516	2,193	16,866	38,422
3	2,153	16,562	62,078	2,153	16,562	62,078	2,143	16,483	54,905
4	1,810	13,921	75,999	1,810	13,921	75,999	2,016	15,509	70,414
5	1,124	8,644	84,643	1,124	8,644	84,643	1,850	14,229	84,643
6	,651	5,009	89,652						
7	,446	3,432	93,084						
8	,417	3,206	96,290						
9	,311	2,389	98,678						
10	,154	1,183	99,861						
11	,017	,130	99,991						
12	,001	,006	99,997						
13	,000	,003	100,000						

Extraction Method: Principal Component Analysis.

a

	Component				
	1	2	3	4	5
T1	,347	-,067	,339	,014	,824
T2	-,014	,534	,036	,001	,771
T3	-,799	,136	-,015	,113	,404
L1	,894	-,162	,129	-,045	,267
L2	,760	,344	-,088	,018	,089
L3	,763	,300	,039	,148	,244
J1	-,079	-,004	,050	,993	,051
J2	-,030	,800	,245	,056	-,152
J3	-,017	,757	-,065	-,033	,454
F1	-,262	-,655	,052	,077	-,135
F2	-,084	,036	-,054	-,989	,036
CF1	,030	,054	,982	,051	,096
CF2	,021	,057	,981	,054	,115

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 11 iterations.

Similarly to the preceding years, the 5 principal components account for close to 85% of the dispersion of the 13 indicators. Analysing the indicator groups we can conclude that the first principal component is sensitive to gearing and liquidity, the second group responds to profitability and the turnover rate to nearly the same extent, the third principal component is of a cash flow type, the fourth one is sensitive to profitability and the turnover rate while the fifth one is of a gearing type.

The above principal component analysis clearly reveals that in the years 2010, 2011 and 2012 differences between the 73 GCHP companies were accounted for by the 5 sets of indicators, whose explanatory power did, however, change from year to year. These principal components proved adequate in every year, as they explained at least 80% of the dispersion of the 13 indicators from year to year.

The next step in the examination of Hypothesis 2 was to determine the monetary positions of the GCHP companies for the above three years. To this end, each GCHP company's indicator group-based value, calculated by the SPSS programme, had to be weighted by the variance value representing the importance of the given indicator group. After that, I assigned the monetary positions of the companies to 5 clusters with the use of the K-means clustering algorithm. Since the cluster analysis produced homogenous groups, the results showed the extent of similarity between the monetary positions assumed by GCHP companies. In addition, with the help of cluster analysis it was possible to find a key GCHP company in each year, whose monetary position most approximated the "0" value – which, at the same time, was the predicted value of the companies' monetary position. To confirm the hypothesis, I then only had to compare the 13 financial indicators of these 3 GCHP companies, since Hypothesis H2 posits that the indicators must assume decreasing values in the consecutive years.

Table 4
Comparison of financial indicators of the three GCHP companies

	Power plant company	MP	T1	T2	T3	L1	L2	L3	J1	J2	J3	F1	F2	CF1	CF2
2010	Pannon-Kogen Ltd.	0,00063	0,84	0,38	0,59	0,81	0,36	-0,08	0,09	0,07	0,17	2,10	0,59	5,31	5,31
2011	Perkons Ltd.	0,08059	0,57	0,34	0,47	0,52	0,28	-0,26	0,03	0,01	0,03	1,24	1,56	0,52	1,11
2012	Kazinc-Therm heating Power Plant Ltd.	0,04997	0,06	0,04	0,08	0,85	0,45	-0,08	-0,08	-0,09	-2,13	2,52	0,47	0,03	0,11

Examination of the financial indicators led to an interesting conclusion. Gearing, profitability and cash flow indicators clearly reflected the tendency outlined in the hypothesis, namely that the relevant indicators of the key GCHP companies would show a declining trend from year to year, i.e. assume a lower value. By contrast, liquidity and turnover rate indicators showed a mixed picture and, in addition, there were differences even within individual indicators. Consequently, I had to dismiss Hypothesis H2, since the monetary position of GCHP companies did not deteriorate on the basis of all factors in the period 2010-2012; that statement was only correct for the gearing, profitability and cash flow positions of those companies.

3.3 Hypothesis 3

In Hypothesis 3 (H3), I studied the trends of cash flow generation capacity of the GCHP companies, regardless of their declining monetary positions. According to Hypothesis 3, after the termination of the mandatory off-take system even the debt service payment capability of these companies could be questionable.

Using the procedure defined in the analytical methodology I calculated each GCHP company's EBITDA value, which is treated in financial analysis literature and applied in commercial banking practice as a relevant indicator of cash flow generation capacity. In performing this step, all that was required was to adjust the operating profit realised by the GCHP company with annual depreciation. The next step was to determine the annual debt service, whereby using the cash flow statement in the annual report's supplementary annex as a basis I took principal repayment and interest payable for the given year, as the sum of these two figures corresponds to the annual debt service. Finally, all that was left was to see whether EBITDA exceeded the value of annual debt service in the individual years.

Given the fact that the mandatory off-take system for GCHP companies was discontinued as of 1 July 2011, I considered it important to also examine the years 2010, 2011 and 2012. That is because in 2010 the mandatory off-take system operated smoothly; in 2011 its impact was only felt for half a year; while in 2012 GCHP companies had to operate without it throughout the whole year. In other words, if we look at the time series for the period 2010–2012, more information van be obtained about changes in the cash flow generation capacity of these companies.

Studying the time series leads us to conclude that the EBITDA realised by 10 of the 73 GCHP companies could no longer cover the annual debt service in as early as 2010; however, that figure only represents about 14% of the entire sample. Further examination of the time series reveals that in 2011 there were as many as 48 GCHP companies (or 66% of the sample) that were no longer able to cover their annual debt service, while in 2012 there were already 52 GCHP companies, or 71% of the entire sample, facing a similarly difficult situation.

The above conclusions have therefore confirmed Hypothesis 3, since the debt service capacity of the GCHP companies sharply deteriorated from 2010; by 2012, as many as 71% of them could no longer generate sufficient cash flow from their core activities to meet their actual debt service obligations.

4. CONCLUSIONS

The analysis has clearly shown that project financing is a popular and widespread form of financing in this area.

Change in legislation, however, considerably reshaped the conditions of financing and not only obstructed new development projects, but considerably impaired the profitability, cash-flow generation capacity and risk position of existing ones. Examination of the above hypotheses raises the question of how this threatening decline of project financing will affect GCHP small power plants in the long run? Some experts believe it threatens Hungarian domestic electrical energy productions in that power plants to be closed down by 2025 represent a total capacity of some 4,100 MW, creating a need for replacement; however, current tendencies do not support such an extent of new power plant development. While this research did not concern itself with these issues, the results could be useful to the competent legislators in developing future amendments to the energy laws. I believe that exploring the relationship between the drop of project financing and the security of domestic supply could be an exciting topic for researchers and experts.

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