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RENEWABLE ENERGY RESOURCES IN NEW HUNGARY DEVELOPMENT PLAN: SOME GENERAL AND SPATIAL CHARACTERISTICS

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The growing significance of renewable energy resources has been one of the most important processes in the field of energy management for the past two decades. This is due to phenomena related to environmental protection, security of supply, economic and rural development, as well as to the abundance of financial incentives (EU grants, constructive national off-take regime). As a consequence of this, the paper concentrates on the general and territorial characteristics of the EU financial instruments for Hungary in the 2007–2013 budgetary period with the objective to enhance the dissemination of renewable energy resources. As an outcome of our research, three very important conclusions were drawn. First of all, less developed regions were more active in submitting proposals though the more developed regions reached higher success rates. Secondly, it was noticed that the "identity" of the successful tenderers influenced the average volume of proposals to a considerable extent. Thirdly, in the case of the successful proposals, the development level and size (of settlements) of the territorial units (districts) had a direct impact on the identity of the applicants and on the average size of proposals.

Keywords: *renewable energy resources, New Hungary Development Plan, territorial disparities, spatial characteristics*

1. Introduction

One of the most important processes observed in the energy management over the last decade is the improved role of renewable energy resources which is the result of several factors. First of all, from the aspect of environmental protection, it must be mentioned that their dissemination contributes to the reduction of the emission of certain pollutants (e.g. CO_2) [1–3]. Secondly, it ensures more secure supplies because of its decentralised nature [4–6]. The third very important factor is economic and rural development [7–12]: the greater use of renewable energy resources may promote the development of the underdeveloped rural regions.

Recognising the importance of the topic, many documents communicated by the European Union and Hungary in the past 10–15 years also emphasised the importance of the dissemination of this energy type. The European Commission in its document entitled "Renewable Energy Road Map", published in February 2007, proposed setting a mandatory target of 20% for renewable energy's share of energy consumption in the EU by 2020 [13]. The Europe 2020 Strategy published in 2010 reconfirmed this target (European Commission, 2010), then according to the draft adopted by the European Parliament in mid-January 2018 this ratio should reach 35% by 2030 [14].

In the course of the accession to the European Union, Hungary made a commitment to achieve 3.6% share of electricity production based on renewable energy resources by 2010 – which target it managed to meet already by the mid-2000s. In order to realise the objective fixed in the Europe 2020 Strategy, Hungary set the achievement of 14.6%, and the same target was named in the document entitled Republic of Hungary National Renewable Energy Action Plan 2010–2020 published in 2010.

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In the spirits of the above, it is not surprising at all that the New Hungary Development Plan Environment and Energy Operational Programme adopted for the 2007–2013 EU budgetary period has a specific priority (Priority 4) for increasing the use of renewable energy resources. According to that document, a total of 395.9 million euro was allocated for the given period (which meant 7.5% of the total budget of the operational programme), 85% of which was granted by the European Union. 20 measures have been developed under the Priority:

- 4.1. Supporting heat and/or electricity production by using renewable energy resources;
- 4.2. Satisfying local heating and cooling demand from renewable energy resources;
- 4.3. Renewable-based regional development;
- 4.4. Renewable-based electricity generation, heat and electricity cogeneration and biomethane production;
- 4.6. Supporting the establishment of low and medium-capacity bio ethanol factories;
- 4.7. Supporting the preparatory and project development activities of geothermal energy-based heat and electricity production projects;
- 4.8. Financial instruments;
- 4.9. Energy modernisation of buildings combined with renewable energy utilisation;
- 4.10. Renewable-based heat and electricity production;
- 4.11. Photovoltaic system development in order to reduce the electricity costs of budgetary authorities and public bodies.

The aim of the study is to analyse the most important specificities of the use of money for the Priority concerned, under which answers are sought to the following questions:

- what kind of general characteristics can be observed for the given Priority and the other EEOP priorities, and each measure within Priority 4;
- what kind of differences can be experienced between the Hungarian counties (Fig. 1), districts and settlements, and what its reasons are.

2. Data and methods

When preparing the study, we used data mainly from palyazat.gov.hu operated by the Hungarian government. It contains data by operational programmes, priorities and measures. Of these, we used the values related to the submitted applications and winning applications for the research and used these to present the observable differences. In the course of calculating the relative (as a proportion of population) data, we used the values as for the population in 2011, and we used the data for the same year when comparing with other indicators during the research. We used the IBM SPSS Statistics Software for the data analysis.

3. Results

The total number of submitted applications for the studied Priority of the Environment and Energy Operational Programme (Priority 4: Increasing the use of renewable energy resources) in the 2007–2013 budg-

Fig. 1. Counties of Hungary

Table 1. Main characteristics of Priority axis 4: Increasing the use of renewable energy resources in the Environment and Energy Operational Programme for the 2007–2013 budget period in comparison with the other priority axes

	A	B	C	D	E	F	G
Priority axis 1	6.4	36.8	7.7	44.8	67.4	85.8	1 604
Priority axis 2	2.2	26.2	2.6	26.9	68.3	72.2	2 828
Priority axis 3	2.7	2.4	3.0	2.4	64.1	70.8	224
Priority axis 4	**37.9**	**13.3**	**34.2**	**6.6**	**50.8**	**35.1**	**53**
Priority axis 5	23.6	12.6	25.0	12.4	59.6	69.0	136
Priority axis 6	13.8	2.4	14.4	1.3	58.9	38.3	24
Priority axis 7	13.0	5.0	12.4	3.5	53.7	49.8	78
Priority axis 8	0.4	1.4	0.7	2.1	93.6	97.2	867
Operational Programme	100.0	100.0	100.0	100.0	56.3	70.4	276

A – share of applications by priorities (%), B – share of requested grant by priorities (%), C – share of granted applications by priorities (%), D – share of grant amounts by priorities (%), E – share of granted applications in the submitted applications (%), F –share of grant amounts in the requested grants (%), G –average amount of granted applications (million HUF/application).
Source: own calculation based on palyazat.gov.hu

etary period was 4 415, which meant more than one-third of all applications submitted for that Operational Programme (Table 1), and the same value applied also for the supported applications. The amount applied for was 340.8 billion HUF (which only marginally exceeded 10% of the amounts applied for in the Operational Programme concerned), while the value is even lower in the case of the winning applications. The significant differences are basically due to two facts: firstly, the ratio of winning applications was the lowest in the case of this Priority (this applied equally to the applications and the actual amounts), and secondly, the amount per person was also significantly below the average of the total Operative Programme.

Studying the most important characteristics of the measures belonging to Priority 4 (Increasing the use of renewable energy resources) (Table 2) significant imbalances may be observed in several respects. First of all, more than 80% of the submitted applications belonged to two measures (4.10. Renewable-based heat and electricity production, 4.2. Satisfying local heating and cooling demand from renewable energy resources) (particularly the former having an almost two-thirds share). This is mainly due to the fact that the

Table 2. Main characteristics of the measures belonging to Priority axis 4: Increasing the use of renewable energy resources in the 2007–2013 budget period

Measures	A	B	C	D	E
4.1.	130	14 186	25.4	28.3	121.8
4.10.	2 792	194 402	48.7	33.6	48.0
4.11.	1	3 500	100.0	142.9	5 000.0
4.2.	1 013	38 045	65.9	52.4	29.8
4.3.	2	2 179	50.0	49.5	1 078.6
4.4.	194	49 974	41.2	32.4	202.5
4.6	0	0	0	0	0
4.7.	9	3 542	22.2	17.7	312.7
4.8.	11	16 002	0	0	0
4.9.	263	18 991	36.1	39.0	77.9
Total	4 415	340 821	50.8	35.1	53.4

A – number of submitted applications, B – amount requested (million HUF), C – share of winning proposals (%), D – grant awarded/amount requested (%), E – average amount of granted applications (million HUF/application)
Source: own calculation based on palyazat.gov.hu

basic purpose of these measures is to support the widespread use of the various renewable energy resources among the private undertakings, budgetary authorities and their institutions (e.g. public administration bodies, local governments and their institutions), and the non-profit organisations, and they proved very popular with the stakeholders because of the really favourable conditions (in certain cases even 100% grant was possible). Regarding the amount of support claimed, however, the picture is more balanced: it is no less true that the role of Measure 4.10 was also outstanding here (almost reached 60%), the remaining 40%, nevertheless, was much more evenly spread between the other measures.

Secondly, regarding the proportion of the winning applications as well as the proportion of the grant awarded to the amount claimed values exceeding the average can be observed in the case of one measure only: the Measure "Satisfying local heating and cooling demand from renewable energy resources" exceeded even 50% for both indicators (Measures 4.11. and 4.3. could not be included in the analysis due to the low number of elements).

Thirdly, when studying the average size of the supported applications significant differences can be experienced: in the case of the two most popular Measures (4.10. Renewable-based heat and electricity production, 4.2. Satisfying local heating and cooling demand from renewable energy resources) one can observe values below the average, while in the case of the other Measures the values found are above the average which can be basically explained by two reasons. For the two measures concerned the tendering specifications mainly preferred the smaller projects, and a significant part of the potential investments (e.g. deployment of photovoltaic systems) also demanded lower costs.

Analysing the data of the applications by counties a specific duality can be observed. First, from the aspect of the tendering activity (Fig. 2), the high activity of the less developed regions is remarkable (moreover, this phenomenon – however, to a lesser extent – has been a constant feature of the entire Environment and Energy Operational Programme). This is basically due to the fact that as a consequence of their unfavourable financial situation the various actors (potential applicants) in the counties concerned (e.g. Szabolcs-Szatmár-Bereg, Somogy and Nógrád counties) were eager to use this fund to reduce the operational costs of the institutions/organisations belonging to them.

Second, regarding the share of winning applications, the effect of the economic development level can be detected also (Fig. 3), but in the opposite direction. Among the top-ranked counties we can mainly find those which are economically better than the average (e.g. Győr-Moson-Sopron, Vas and Tolna counties), while those with lower success rates include almost only less developed counties (e.g. Baranya, Nógrád and Somogy counties).

Looking at the winning applications (Fig. 4), the local governments were the most successful with regard to the identity of applicants, followed by the

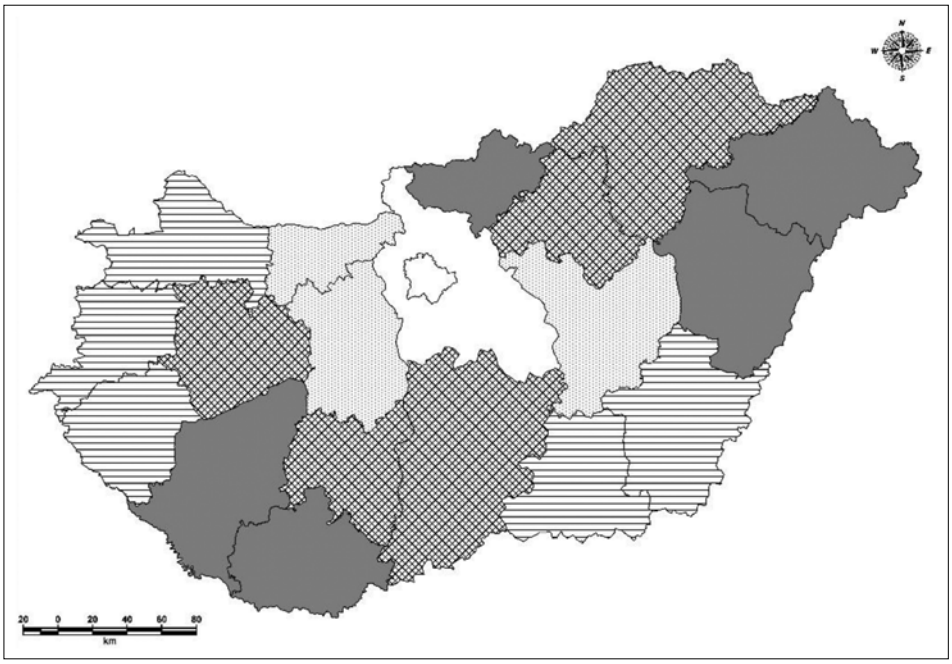

Fig. 2. Tendering activity in Priority axis 4 of the Environment and Energy Operational Programme in the 2007–2013 budget period, by counties (number of applications submitted per one thousand inhabitants). *Source:* own calculation based on palyazat.gov.hu

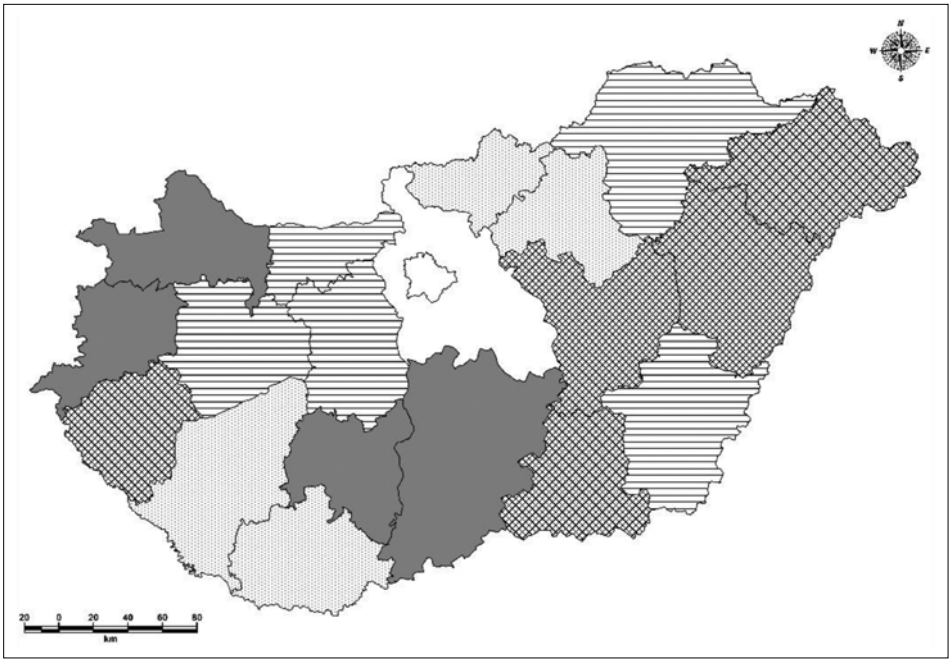

Fig. 3. Success rates for proposals in Priority axis 4 of the Environment and Energy Operational Programme in the 2007–2013 budget period, by counties (number of winning applications/number of submitted applications, %). *Source:* own calculation based on palyazat.gov.hu

private undertakings, while the share of the other actors was below 10%. The high values for the first two actors can be explained by several reasons. First of all, from among the potential applicants (meaning the same group of actors for most measures: private undertakings, budgetary authorities and their institutions, non-profit organisations) the local governments have the biggest building stock on the settlements whose energetic modernisation/supply with renewable energy resources led to significant savings for them. Secondly, the cost-reduction resulting from the investments meant an important attractiveness for the private undertakings, too.

In view of the average size of the applications, the health care institutions rank first which is mainly due to the fact that the developments were decisively implemented in hospitals, and the modernisation of institutions comprising of several buildings required significant amounts.

A more detailed analysis of the educational institutions and the private undertakings (Table 3) clearly indicated the differences within the particular groups.

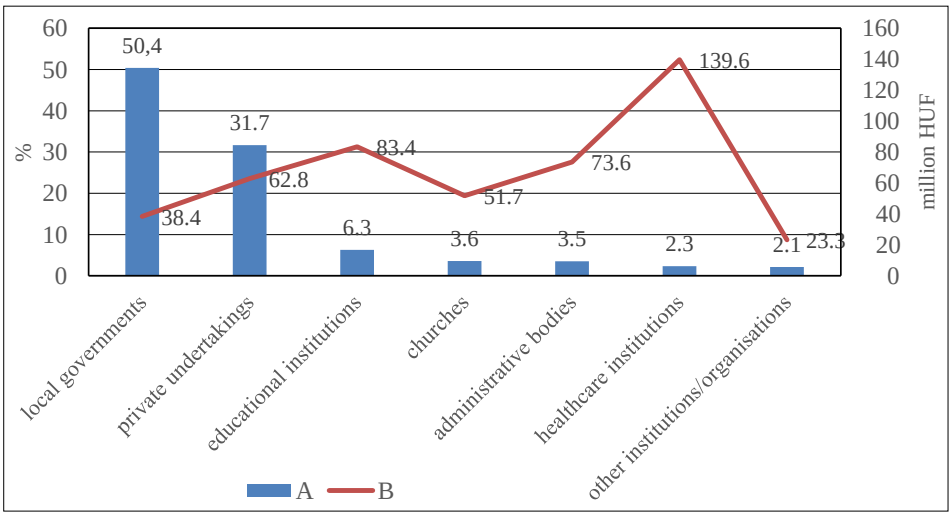

Fig. 4. Main characteristics of winning applications in Priority axis 4: Increasing the use of renewable energy resources in the Environment and Energy Operational Programme for the 2007-2013 budget period. A – share in total number of applications (%), B – amount per application (million HUF). *Source:* own calculation based on palyazat.gov.hu

Table 3. Size of average granted applications by the different types of educational institutions and private undertakings in Priority axis 4 of the Environment and Energy Operational Programme in the 2007–2013 budget period (million HUF)

Applicants	Amount per application (million HUF)
Public kindergartens, primary and secondary schools	35.5
Ecclesiastical kindergartens, primary and secondary schools	69.7
Higher education institutions	170.4
Individual enterprises	9.4
Limited partnerships	12.3
Limited liability companies	65.9
Limited companies	137.9

Source: own calculation based on palyazat.gov.hu

Table 4. Characteristics of the winning proposals based on the development level of the districts in Priority axis 4 of the Environment and Energy Operational Programme in the 2007–2013 budget period

	A	B	C
First decile	20 761	43.4	47.81
Second decile	15 775	43.5	36.24
Third decile	17 570	35.1	50.08
Fourth decile	11 173	28.2	39.68
Fifth decile	18 371	42.8	42.94
Sixth decile	24 907	37.5	66.38
Seventh decile	14 713	31.5	46.72
Eighth decile	18 489	28.2	65.58
Ninth decile	11 051	25.3	43.67
Tenth decile	18 247	28.2	64.79

A – amount of grant per inhabitant (HUF), B – number of applications per one hundred thousand inhabitants,
C – average size of applications (million HUF/number of application).
First decile – least developed districts, tenth decile – most developed districts.
Source: palyazat.gov.hu, 290/2014 (XI. 26.) Government Decree on the classification of beneficiary districts

In the case of the former the outstanding figures for the higher educational institutions can be explained by the reason mentioned in relation to the healthcare institutions. The difference between the state and ecclesiastical schools can be primarily explained by the fact that in the case of the latter the majority of the applicants combined several institutions (e.g. kindergarten, elementary school, secondary school/secondary vocational school), and thus the development required higher amounts, and due to the governmental preferences these organisations could grant more own contribution which led to tenders with higher budget.

The differences observed in the case of the private undertakings can be mainly explained by the fact that the companies with increased capitalisation (e.g. limited liability companies, limited companies) could ensure much more own contribution and this affected the size of the investments, too.

Analysing the spatial distribution of the winning applications, the first level was constituted by the districts where the socio-economic development level was a determining factor from many points of view. On the one hand, it may be concluded that the situation of districts shows relation with the relative number of the applications (per 100 000 people): the more developed a district is, the lower number we get for this value (Tables 4 and 5). As opposed to this, no such

Table 5. Strength of the relationship between the development level of districts and winning proposals in Priority axis 4 of the Environment and Energy Operational Programme in the 2007–2013 budget period

	A	B	C
Pearson correlation coefficient	–0.144	–0.222*	0.062
Spearman's rank correlation coefficient	–0.100	–0.207*	0.040

A – amount of grant per inhabitant (HUF), B – number of applications per one hundred thousand inhabitants, C - average size of applications (million HUF/number of application)
* – the relationship is significant at the 0.01 level
Source: palyazat.gov.hu, 290/2014 (XI. 26.) Government Decree on the classification of beneficiary districts

Table 6. Relationship between the development level of the districts and the applicant organisation in Priority axis 4 of the Environment and Energy Operational Programme in the 2007–2013 budget period

	A	B	C	D	E	F	G	H
First decile	63.4	5.2	23.8	2.9	1.7	1.2	1.7	0.0
Second decile	67.2	3.4	18.1	1.1	3.4	5.6	0.0	1.1
Third decile	68.4	1.8	17.5	4.1	2.9	1.8	2.3	1.2
Fourth decile	54.9	7.1	19.5	4.4	5.3	3.5	2.7	2.7
Fifth decile	62.9	4.6	19.1	5.2	3.1	2.1	1.5	1.5
Sixth decile	54.6	2.8	19.3	14.7	2.8	1.4	1.8	2.8
Seventh decile	44.2	6.0	32.1	4.6	3.7	5.6	2.8	0.9
Eighth decile	44.5	2.6	31.9	6.6	5.2	1.7	3.9	3.5
Ninth decile	41.4	2.8	32.3	6.7	3.5	5.6	4.2	3.5
Tenth decile	35.6	5.2	38.7	7.7	4.1	4.5	1.7	2.4
Average	50.4	4.1	27.6	6.3	3.6	3.5	2.3	2.1

A – local governments, B – individual enterprises and limited partnerships, C – limited companies and limited liability companies, D – educational institutions, E – churches, F – administrative bodies, G – healthcare institutions, H – other institutions/organisations
First decile – least developed districts, tenth decile – most developed districts
Source: palyazat.gov.hu, 290/2014 (XI. 26.) Government Decree on the classification of beneficiary districts

connection can be found in the case of the other two indicators which is clearly indicated also by the extremely low value of the correlation coefficient.

On the other hand, the socio-economic development level of the districts may influence the identity of the applicant to a certain extent (Table 6): the more developed a district is, the lower the proportion of the local governments and private undertakings (and especially of the limited companies and limited liability companies) will be. This trend is primarily due to the fact that with the increase in the development level the capitalisation of the stakeholder economic organisations also increases, and thus they could ensure own contribution necessary for the tenders to a growing degree.

The higher proportion of local governments in the less developed regions can be explained by the fact that in these territorial units the other actors/potential applicants (e.g. educational and healthcare institutions) are represented only to a modest extent and this fact affected their tendering activities also.

The second level in the analysis concerning the spatial distribution was constituted by the settlements (municipal level). The winning applications were sub-

Table 7. Characteristics of winning proposals in the light of the size of settlements in Priority axis 4 of the Environment and Energy Operational Programme in the 2007–2013 budget period

	Share of settlements with winning proposal(s) from all settlements, %*	Grant amount per one winning proposal, 1000 HUF
– 499	5.7	28 374
500 – 999	22.5	34 863
1 000 – 1 999	44.2	30 882
2 000 – 4 999	69.7	46 285
5 000 – 9 999	89.6	59 486
10 000 – 24 999	94.0	61 502
25 000 – 49 999	100.0	58 580
over 50 000	100.0	83 855
Hungary	32.3	52 727

* – without the settlements of Pest county
Source: palyazat.gov.hu

Table 8. Winning applicants in the light of the size of settlements in Priority axis 4 of the Environment and Energy Operational Programme in the 2007–2013 budget period

	A	B	C	D	E	F	G	H
– 499	56.6	2.6	26.3	1.3	3.9	3.9	0.0	5.3
500 – 999	75.7	2.2	16.6	1.7	1.1	2.2	0.0	0.6
1 000 – 1 999	77.7	2.4	14.2	1.6	1.8	1.0	0.0	1.3
2 000 – 4 999	70.7	3.6	17.2	1.1	3.1	2.9	0.2	1.1
5 000 – 9 999	48.1	6.4	27.9	6.4	4.3	3.9	0.4	2.6
10 000 – 24 999	35.9	5.0	29.2	12.6	4.3	2.0	7.0	4.0
25 000 – 49 999	21.5	5.2	40.1	14.5	4.1	2.9	9.3	2.3
over 50 000	7.0	5.1	54.2	12.7	6.2	8.9	3.5	2.4
Hungary	50.4	4.1	27.6	6.3	3.6	3.5	2.3	2.1

A – local governments, B – individual enterprises and limited partnerships, C – limited companies and limited liability companies, D – educational institutions, E – churches, F – administrative bodies, G – healthcare institutions, H – other institutions/organisations
Source: palyazat.gov.hu

mitted by 957 settlements constituting almost 33% of the potential settlements (excluding Pest county). The size of settlements, however, had a considerable influence in several respects. First of all, it has been observed that the ratio of winning applications was much lower on the smaller settlements (Table 7), while there were hardly any settlements among the bigger ones without winning applications. Secondly, with the increase in the size of the settlements the amount of grant per winning application also showed an increasing trend (in this case, however, the Pearson correlation coefficient was only 0.111 which refers to a much too little relation).

The explanation for the two phenomena is in particular based on the fact that the availability of adequate financial resources for submitting – especially high-cost – applications is limited on the smaller settlements.

Secondly, as the size of the settlement increases there are significant changes in the "identity" of the winning applicants also (Table 8). In the case of the smaller settlements (with less than 5 000 inhabitants) local governments have been instrumental, while the importance of the other actors can be considered as minimal (the only exception being the settlements with a population number less than 500). The phenomenon, in all likelihood, is the result of the fact that the economic actors on these settlements are yet notably weak, and the other – using in principle state funds – organisation has only limited financial resources and buildings that could be taken into account from the aspect of renewable energy resources.

As the size of the settlements increases, however, the role of the other actors gradually increased. In the case of the economic actors, the greater financial power characterising the private undertakings of the more populated settlements causes the higher share, while in the case of the educational, ecclesiastical, administrative and healthcare institutions/organisations these settlements have those objects where such modernisation could be implemented. The fact above is notably true in the largest settlement category for the administrative institutions, the churches and within the educational institutions the universities (in this case their share was 4.3% as opposed to the national average of 1.1%).

In the group of the settlements with a population number between 10 000 and 50 000, the share of the ecclesiastical educational institutions and healthcare institutions also highly exceeded the average (the former being around 10%, while the national average was 4.6%). The former being partly the result of the fact that this is the group of settlements where the churches took over a considerable number of schools in comparison with the total number of educational institutions of the settlement, whose modernisation the state considered as a very important task.

4. Conclusions

The most important conclusions of the study are the following:

- The less developed regions were more active in tendering, however, the more developed regions were more successful in tendering.
- In the case of the winning applications the "identity" of the applicants significantly affects the average size of the applications.
- In the case of the winning applications, the development level of the territorial units (districts) and size (settlements) affect the identity of the applicants and the average size of the applications.

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