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PhD thesis abstract

**The Future of Civil Solid Waste Management
in the South Transdanubian Region**

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I. INTRODUCTION

Modern waste-placement has bigger and bigger difficulties in Hungary. The science of geography helps to choose the optimal settlement (in case of all types of waste, from the point of view of unloading and neutralization as well) by offering a research method in complex aspect, which gives an ideal solution along with the minimum endangering of the environment and society.

While I was working on the topic, I met problems coming from the lack of communication several times. There are ones during the organization from above (e.g. determining a regional waste-burning station or the settlement of a dangerous unloading area), but we can meet its opposite as well. An obvious example for this is that the border of projects are determined not in accordance with the economical and professional expectations, islands, tongues are formed according to the individual economical, political interests.

There is no alternative of the unloading – with the purpose of neutralization in the South Transdanubian region. I underlined it several times in my previous works that the primacy of prevention is not a question. On one hand the lack of thermal exterminators is a disadvantage as the necessary infrastructure has to be built, but there are institutions which can be developed. The development possibilities should be examined individually, as the transformation of certain power stations can be done only by the change of technique, which can mean big expenses on one hand, on the other hand it can come up against the resistance of the civil sphere. However, the regulations of the European Union and Hungary force us to do these energetical developments, for this reason its systematical realization must be started so that as much as possible resources could be got from the 2007-2013 EU budget.

The situation of waste in the environment (and so in the environment protection, too) is Janus faced from several aspects. The economical growth has brought along the change of our consumption habits and as a consequence of this process the loading of our environment has grown in a bigger and bigger degree (at a quick pace) as well. One of the reasons of the process can be the increasing necessity of raw materials, the indirect result of which is also the growing quantity of waste of production (although this question is quite sensitive, because the available technology influences the volume effectively). The quantity of the arising waste has risen in a bigger extent by the way that we use more from everything and for a shorter time than it would be ideal. A certain social pressure is associated with it: there is always a more beautiful, better, more modern, cleverer, more usable one.

The double-face also appears during the management of waste:

- On one hand in case of the **not proper** (incorrect, in some cases none) management it is a potential polluting resource for the majority of the environmental elements / e.g. soil, (underground-)water, atmosphere/, it can be dangerous for the human society and other, not less important groups of living world. Moreover, its sight and smell (in some cases stink) also influences our general condition and attitude to the environment. (In a lucky case it happens in one direction and thoughts are followed by action in a way that we collect the rubbish.)
- On the other hand, during the **proper** (environment-conscious) management the waste can become raw material and source of energy for other economical activities. This way the loading of our environment can be reduced by the way that the use of waste can substitute one part (in some cases the whole) of the primary raw materials. The re-utilized (second- from this point) raw material stops being a source of danger for its environment by avoiding its unloading (perhaps burning).

These last two approaches show us that in fact waste is not rubbish. Besides the conceptual differences, which will be discussed later, it is necessary to refer to the source of power-source of danger duality. To say it in a simple way: the rubbish, which can be utilized (because for example it is selected), is named waste. In a reverse way: the part of waste, which cannot be utilized – for example chaotic pile of heterogeneous materials from quality aspect (household rubbish) - , is the rubbish.

As this chain of thoughts shows: if a product becomes waste or rubbish at the end of its life, mainly depends on the fact how consciously the person, who used or utilized it, thinks about his/her environment and its protection. If we say it very precisely, theoretically every segment manufactured and used by people of civil solid waste (dangerous-, inert- and civil liquid waste does not go here) can be re-utilized. What can often throw obstacles is the environmental sensitivity and the lack of motivation of the individuals and sometimes of the players of the society and also the lack or not knowledge of the proper technology. It may happen that there-utilization is disadvantageous from an environmental aspect, if the necessary costs(e.g. transportation) – in the lack of proper techniques and technologies – cause bigger environment-loading.

II. AIMS

The thesis deals with the sustainable management of the civil solid waste with the not hidden purpose to argue for and against the landfills and thermal proceedings. However, before this it is necessary to clarify the concept and types of waste, the legal regulational system in connection with the management of waste in Hungary and the European Union, the quantity and – possibly – quality of waste, arising in the region, the alternative forms of management, the advantages and disadvantages of the certain possibilities.

I tried to answer for the following questions in my essay:

1. What is the quantity and quality of the civil solid waste, produced in the region and how is it neutralized?
2. What kinds of ways of sustainable waste management are there in the South Transdanubian Region?
3. Is there any relation between the quality of civil life (urbanity) and quantity of the produced waste?
4. Is it possible to indicate a central area in the region where there can be a reality of a possible big investment considering the arising waste-quantities and transportation possibilities?

III. METHODS OF RESEARCH

Processing of primary sources: waste management, as an economical activity is widely regulated both in the European Union and in our country. While analysing the documents, we can express critical comments for only the ‘greenness’ of regulation. However, in my opinion in the age when scientists – as mainly theoretical experts whose research results will be accepted (or not) in practice – fight for the sustainability of development, a rather practical problem like this must not be and cannot be approached exclusively, the small steps pointing ahead may be worth more than the ‘shock therapy’ in this case.

When processing the sources, we have to mention the results of the already existing conceptions (New Hungary Development Plan, II. National Environmental Protection Programme, National Waste Management Plan, Environment Developing Plan of the Strategic Development Programme of the South Transdanubian Region (SFP), Waste Management Plan in the South Transdanubian Region and ‘The Alternatives and Terms of

Energetic Utilization of Civil Waste’, an essay, noted by MKM Consulting Ltd. I have updated and interpreted the results of these researches as far as possible.

Analysis of database: in case of researches in connection with territoriality, I took the latest database of ‘Központi Statisztikai Hivatal (KSH), available for me as by starting - point. As in several cases there was no reality of civil analysis, the research of small regions in KSH seemed to be rational.

I have to emphasize it here that while working out the environmental developing plan, mentioned above, we were making questionnaire surveys, I took part in putting it together and in its evaluation and they – as data base – gave us useful information.

Setting up a data base: comparison of the inhabitants in the South Transdanubian Region and the quantity of civil waste, produced by them based on the data of KSH and suppliers working in the region. By further developing of this data base (with the growing volume of the quantity of the arising waste), I would like to prognose the expected quantity of the arising waste for the years 2015 and 2025. Its practical significance comes out during the research of the returns and economical operation of the big investment, as a long-range investment.

I will represent the data, which I have got, by graphical methods (Adobe Photoshop CS2, MS Paint) to make the proceedings more expressive by this, and I also would like to help to choose the settlement of the (possibly) future big investments. The quantity of the waste, which should be transported, also influences where the most suitable place would be, as it is obvious: it is not logical to transport a big quantity for a long distance. So if we multiply the quantity of waste, produced in a certain small region by the distance of transportation (km), we get a guide number in case of every potential field of activity. The smallest number is the most advantageous from the point of view of environment loading. I used a route planning programme (viamichelin) – available for everybody – to determine the distances. I indicated different priorities so that the transportation should be as economical as possible from the point of view of both finance and environment loading. They were the following:

- As high-class road as possible, without the obligation of paying road-toll.
- The central settlement of the small region is the standard from the point of view of the starting and arriving points.

I compared the distances of road transportation with railway possibilities. What gave me the possibility to do this was the database of the official timetable ‘Elvira’ of the state railway company (MÁV Start Zrt.).

When I examined the quality of civil life and the quantity of the produced waste, I used Spearman rank-correlation from among the statistic methods, used in geography to establish what kind of connection is between the urban life style and the quantity of waste per person. I calculated main points to indicate the central area.

IV. RESULTS

1. What is the quantity and quality of the civil solid waste, produced in the region and how is it neutralized?
2. What kinds of ways of sustainable waste management are there in the South Transdanubian Region?

I consider it reasonable to answer the two questions together, since there is connection between them.

- When I was writing my thesis I established that the quantity of waste production for one unit of the national income was decreasing, as the national income (GDP) was increasing much faster than waste production after the turn of the millennium.

- Civil solid waste is collected in the region by 7 bigger suppliers (BIOKOM Kft., Zöldfok Rt., KVG Rt., Rumpold-Marcali Kft., Saubermacher-Pannonia Kft., Alisca Terra Kft., Komlói Vg Rt.), their activity covers 646 settlements. The waste management is completed on the other 8 settlements by smaller economic organizations and local governments.

- According to my researches the unloading is a widespread method of neutralization in the region, but due to complex waste management programmes selected collection and utilization in its material are emphasized. We would have definitely reliable data about the quantity of waste put down, if every landfill had platform scale and there was recording of the quantities, coming in. These data would not still cover the real quantity of the waste produced, as illegal unloading is still a problem. Waste collection is organized in every settlement and it is a very happy fact that it is only a very small part of households which is not in the system.

The results of researches on the characteristics of regional waste treatment:

There are 13 waste unloading areas in county Baranya, 11 ones in county Somogy and there is 1 in county Tolna, which have permission for operation from 1st January, 2006. There are only 6 ones from these, which have proper technical protection, in the lack of which the waste unloading areas are not satisfactory from the point of view of environment protection, as they

are not provided by isolating system, there is no flowing-water piping, they are not fenced in. Most of the unloading areas in the region were pointed out by council decisions in years 1960-1970. Mine-holes, left for unloading or uncultivable areas lying deeply on the border of settlements were pointed out. The problematic question nowadays and in the future as well is the recultivation of the illegal unloading areas, which have already been behind or will be left behind soon. The organized collection – with the exception of bigger territorial suppliers – is done by out-of-date vehicles, which are not able to condense. Any form of selective collection is realized only on a little more than one third of the settlements of the region.

From among the regional waste management projects the following ones cover the area of the region (*Diagram 1.*):

- South –Balaton and Sióvölgy Civil Solid Waste Treatment Project (ISPA – Cohesion Foundation – approved, 202 settlements, 372 inhabitants supplied)
- Mecsek-Dráva waste Management Project (Cohesion Foundation – getting ready, 295 settlements, 427,437 inhabitants supplied)
- Kaposmenti Waste Management Project (Cohesion Foundation – being planned, 144 settlements, 196,000 inhabitants supplied)

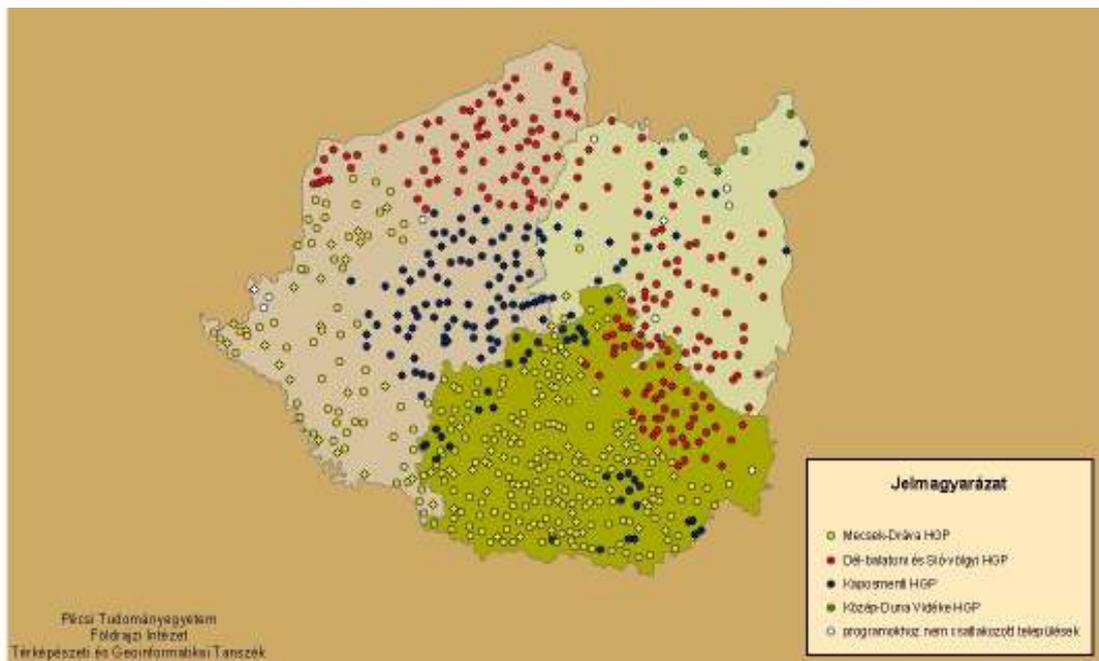


Diagram 1.:Distribution of settlements, joined the waste management programmes in the South Transdanubian region (source:SFP 2006)

The regional extension of the three waste management projects should be corrected, which is motivated by the realization of the service and the increase of its economical effectiveness. The reason of this is that in the moment of joining the settlements considered not the interest of the project, but the price and value of the activities, offered by the suppliers or sometimes the success or failure of earlier cooperations. I summarized the data of the quantity of civil solid waste, produced on areas, treated by the three waste management projects (*Table 1*).

Table 1: Main territorial parameters of regional waste management programs (2006)

Name of waste management project	Inhabitants supplied	Settlement supplied	Town from this	Quantity of produced waste (t)
Mecsek-Dráva	439 597	319	16	173432
Dél-Balaton és Sióvölgyi	372 351	205	15	143847
Kaposmenti	184 489	118	3	93993
Settlements not joined	7045	6	0	2516
Altogether	1 003 482	648	34	412 788

(Edited by G. BARANYAI, 2007)

Settlement level approach is more interesting for me than the regional one. By this I have the opportunity to determine the ‘areas’ where the quantity of raw material or the material, waiting for neutralization is significantly high. I will examine the territorial aspect from the following point of view: Is there any connection between the legal status of the settlements and the quantity of waste, produced by them. I consider it important to examine the settlements on a town-village basis, because calculations prove that the quantity of waste per person in towns – it is especially true for bigger towns and cities – is bigger. *Diagram 2*. shows that the waste production in towns is bigger in its ratio (2005:490kg) than in villages (2005:313 kg). I grouped the more than 50 settlements to do further examinations on the basis of statistical small regional ranging.

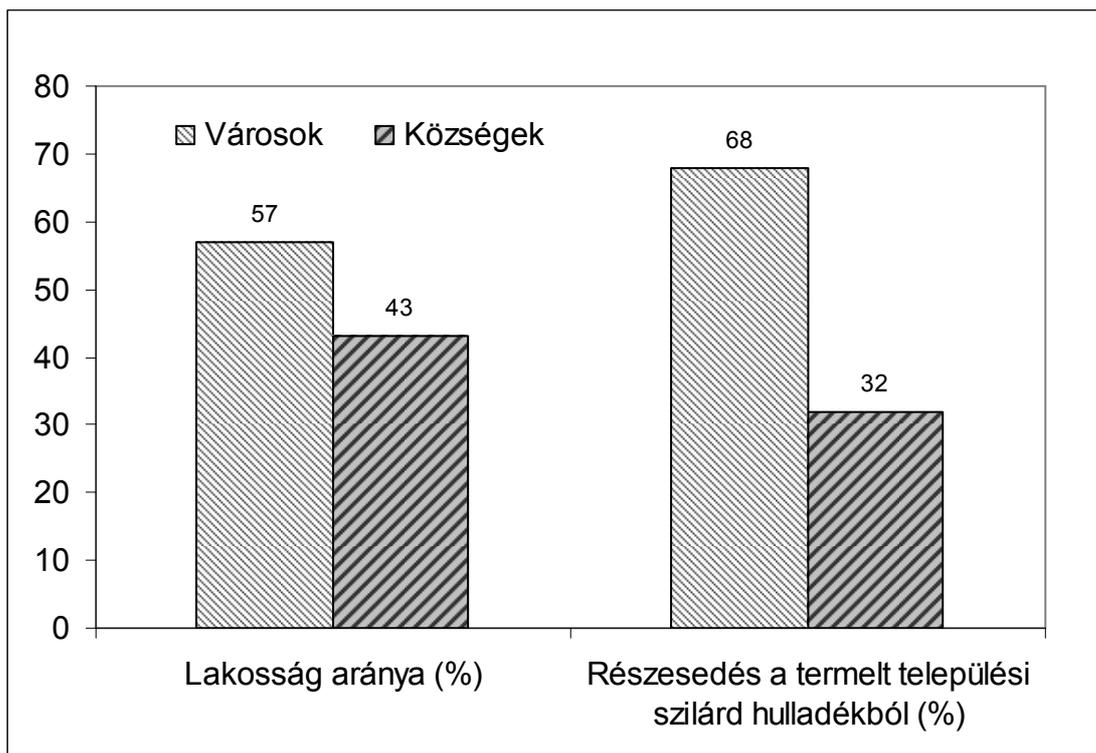


Diagram 2.: The distribution of inhabitants and the ratio of produced waste (2005)
(Edited by G. BARANYAI, 2007)

(Lakosság aránya: *Ratio of inhabitants*, Részesevés a termelt települési szilárd hulladékból: *Share from the produced civil solid waste*, Városok: *Towns*, Községek: *Villages*)

3. Is there any relation between the quality of civil life (urbanity) and quantity of the produced waste?

I determined the urban character of small regions based on the fact how big the ratio of the urban population is compared to the population of small region and I also calculated the quantity of the produced waste in the certain small regions

I established on the basis of the database (Table 2.) that a big part of small regions, where the biggest ratio of the population lives in towns, leads in the production of waste per person, and it is necessary to transport the waste the most rarely from the inhabitants' households in the more 'village-type' small regions.

To prove this I determined the Spearman rank-correlation coefficient (r_s) to establish how strong the relation is.

Table 2: Relations between the urbanity of small regions and the quantity of waste, produced by them (2006).

Order of small regions based on the ratio of urban population			Place in quantity of waste per person	Order of small regions based on the produced material (kg) per person	
1	Pécsi kistérség	86%	7	Paksi kistérség	780
2	Kaposvári kistérség	67%	5	Siófoki kistérség	599
3	Komlói kistérség	66%	4	Fonyódi kistérség	558
4	Siófoki kistérség	64%	2	Komlói kistérség	521
5	Szekszárdi kistérség	61%	23	Kaposvári kistérség	507
6	Fonyódi kistérség	59%	3	Balatonföldvári kistérség	481
7	Paksi kistérség	59%	1	Pécsi kistérség	465
8	Dombóvári kistérség	59%	9	Sellyei kistérség	400
9	Siklói kistérség	49%	11	Dombóvári kistérség	364
10	Bonyhádi kistérség	49%	18	Mohácsi kistérség	356
11	Szigetvári kistérség	48%	15	Siklói kistérség	351
12	Szentlőrinci kistérség	45%	14	Csurgói kistérség	341
13	Mohácsi kistérség	45%	10	Sásdi kistérség	330
14	Barcsi kistérség	45%	17	Szentlőrinci kistérség	330
15	Nagyatádi kistérség	43%	19	Szigetvári kistérség	326
16	Marcali kistérség	38%	16	Marcali kistérség	321
17	Csurgói kistérség	35%	12	Barcsi kistérség	310
18	Pécsváradi kistérség	30%	21	Bonyhádi kistérség	308
19	Tabi kistérség	30%	20	Nagyatádi kistérség	291
20	Lengyeltóti kistérség	29%	24	Tabi kistérség	280
21	Tamási kistérség	28%	22	Pécsváradi kistérség	271
22	Sásdi kistérség	22%	13	Tamási kistérség	268
23	Sellyei kistérség	21%	8	Szekszárdi kistérség	261
24	Balatonföldvári kistérség	18%	6	Lengyeltóti kistérség	229

(Edited by G. BARANYAI, 2007)

According to the result of the examination ($r_s=0.5$) the relation is not too strong, so urban life cannot be correlated closely with the waste production habits of the population. It contradicts the relation shown on diagram 2 to some extent, but we can understand that in towns it is not only the people living there who produce waste, if we think it over that towns rise out from their surroundings because their functions (sphere of action, the area they need to supply) go beyond their borders.

I did the same research to prove the thesis, according to which consumers' habits change for the influence of higher incomes and more waste is produced among the inhabitants through this. The antecedents of this are that an essay with the title 'Development and Environment' came out in 1992 with the support of the World Bank and this essay examines the relation between growth and environment pollution along with other issues. Concerning the civil solid waste it notices the higher the GDP per person, the more the civil waste is.

When evaluating, we have to consider that the income per person covers the sometimes significant individual differences. According to my calculations the correlation between the quantity of waste, produced by small areas and income-relations are characterized by factor 0.2, so it is definitely not true that the more money people earn, the more waste they produce, at least our region does not prove this. It is interesting that the first and last member of the order would prove the results of World Bank experts, but significant dispersion can be seen between the other small regions with slight correlation. The third approach is in connection with the previous one to some extent, because it supposes that the least the unemployment is, the more inhabitant has some income (and so the opportunity to produce some waste). The drawback of this approach is that the ratio of registered unemployed people is certainly less than the one of the real unemployed people. According to my calculation the correlation between unemployment and individual waste production habits is stronger to some extent ($r_s = 0.4$) than in the similar connection of quantity of waste per person and income, but the South Transdanubian Region did not really prove the statements of the World Bank's experts for me.

4. Is it possible to indicate a central area in the region where there can be a reality of a possible big investment considering the arising waste-quantities and transportation possibilities?

It is possible to determine the spatial concentration the produced waste by the fact that we know the number of inhabitants in the certain small region and the quantity of household solid waste, produced by them. Its significance can be in the process of indicating the settlement of the big investment (waste-burning station), as the transportation routes can be rationalized by this. It is advisable to look for a place for the activity mainly on the area of big producing small areas (especially if there are more ones close to each other)(*Diagram 3*).

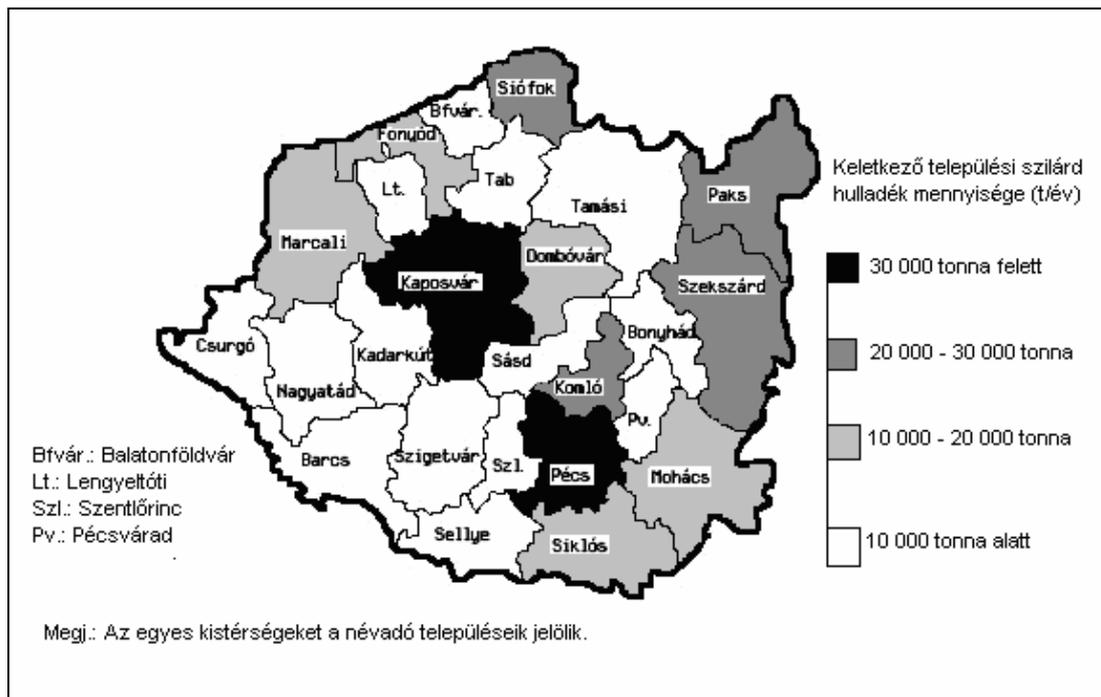


Diagram 3: The quantity and distribution of civil solid waste, produced in the region
 (Edited by G. BARANYAI, 2008)

It is weighting as a statistical method, used in geography, which gives us the possibility to determine the different central areas of the region. (J., NEMES NAGY 2003, T., BUGYA 2003). The result of calculation of the geometrical weight, done by co-ordinates of small region centres, can be compared by the weight, corrected by the quantity of waste, produced in the certain small area.

The arithmetical mean value of geographical co-ordinates determines the geometrical centre of the region, which can be found at the point of intersection of 46.23° north latitude and 17.99° east longitude (on the outskirts of village Gödre), and the weight of waste production of the small regions in the region is Dalmand (46.29° north latitude, 18.10° east longitude) (Diagram 4).

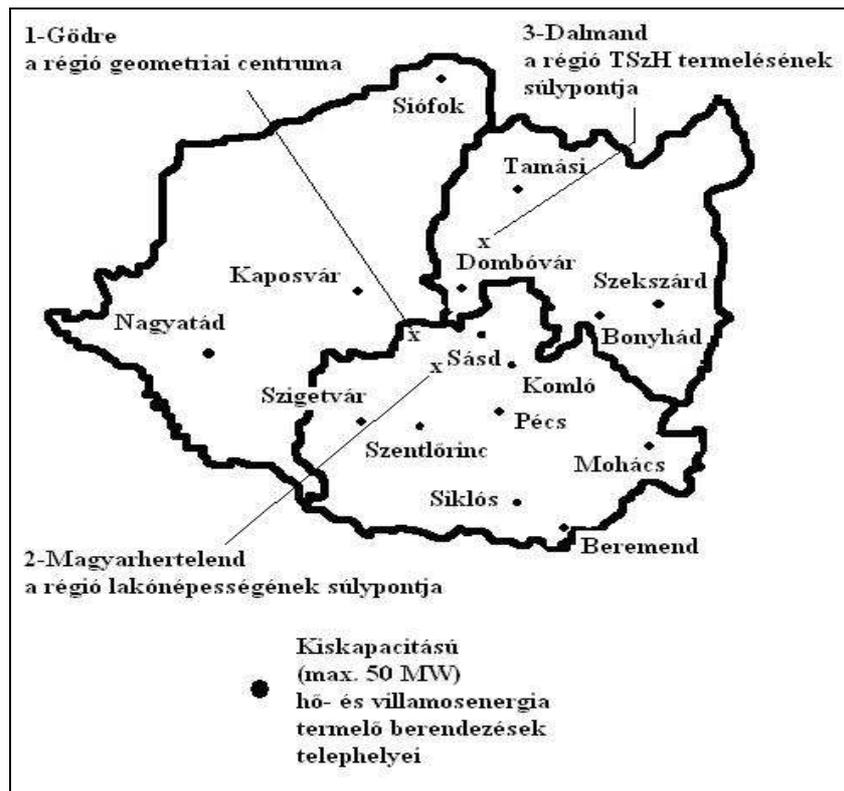


Diagram 4: Position of examined weights and low-capacity heat power stations in the region
(Edited by G. BARANYAI, 2008)

Based on the quantity of waste, produced in the certain small regions and calculations of weights, I concluded that the point where a burning station could be placed is in the area of a pentagon, indicated by the points Pécs-Dombóvár-Sásd-Komló-Kaposvár. All of these towns already have a power station, so the situation is quite favourable if the problems of expenses of the big investment would be solved by block-transformation. If we look at the map of the South Transdanubian region, the situation of Sásd seems to be the most favourable, as it is close to the centre. However, the quantity of waste which should be transported also influences the choice of the perfect place, as it is not reasonable to transport a big quantity for a long distance. If it is transported on road, multiplying the quantity of the waste, produced in the certain small regions by the transportation distance (km), we get a guide number in case of all the five potential towns. I named this guide number ‘waste-ton-kilometre’ (wtkm). The smallest number is the best value from the point of view of environment loading.

I examined all the small regions in the region for the first step, then I left out the small regions, in which more than half of the settlements joined the South-Balaton and Sióvölgy Waste Management Programme, from the database, because this programme does not plan the operation of a regional waste burning station (*Table 3.*).

Table 3.: Summary of wtkm calculations

Field of activity	Wtkm (ISPA and KA together)	Htkm (only KA)
Pécs	22 341 128	13 207 114
Kaposvár	25 433 202	18 172 211
Komló	22 574 046	14 219 026
Dombóvár	23 658 298	17 691 722
Sásd	21 773 691	14 358 025

(Edited by G., BARANYAI 2008)

My calculations confirm that definitely the field of activity in Pécs would be reasonable if we tried to make an economically rational decision based only on the numbers.(It is proved on the basis of the contracted database, but it is this database which is important, as the waste which comes from the area, treated by ISPA project, will be unloaded.). It is due to the fact that Pécs and its small region would be able to supply a 100,000 ton capacity burning station almost by itself. It can also be seen that although the situation of Kaposvár in the territory seems to be more favourable, even Komló, Sásd and Dombóvár are more competitive to indicate the place of a burning station from the point of view of road transportation. Another question is that the same reason would become trump in the hand of Kaposvár if the inhabitants refused the initiation.

Of course a question comes up: Is it railway or road transportation which is more economical? It was not the task of the thesis to analyze the road and railway anomalies of the region so I did not discuss the advantages and disadvantages of the transportation methods in details. If we accept that it is Pécs which would be suitable for the place of a regional burning station, we can see that in certain cases the waste should be transported unreally lot by rail (e.g. in case of Paks, Szekszárd, Siófok, Bonyhád) and the distance is shorter only in relation of Barcs, Sellye, Szentlőrinc, and Pécsvárad. While it is the ‘large-scale producers’ who go into the first group, it is the ‘small-scale producers’ who go to this last group (*Table 4.*).

Table 4: The difference of railway and road relations on the example of Pécs

Small region	Distance from Pécs on road (km)	Distance from Pécs by rail (km)	Difference from the point of view of railway transportation
Pécsi kistérség	1	1	0
Kaposvári kistérség	74	95	+20
Paksi kistérség	89	197	+108
Szekszárdi kistérség	59	143	+84
Komlói kistérség	20	66	+46
Siófoki kistérség	124	190	+66
Mohácsi kistérség	40	60	+20
Fonyódi kistérség	127	148	+21
Siklói kistérség	31	n. é.	-
Dombóvári kistérség	47	64	+17
Marcali kistérség	126	172	+46
Tamási kistérség	82	n. é.	-
Bonyhádi kistérség	40	106	+66
Szigetvári kistérség	33	34	+1
Nagyatádi kistérség	102	144	+42
Barcsi kistérség	65	64	-1
Kadarkúti kistérség	63	n. é.	-
Sellyei kistérség	48	43	-5
Balatonföldvári kistérség	117	175	+58
Csurgói kistérség	126	130	+4
Szentlőrinci kistérség	20	19	-1
Sásdi kistérség	32	51	+19
Tabi kistérség	101	160	+59
Pécsváradi kistérség	19	18	-1
Lengyeltóti kistérség	106	136	+36

(Edited by: G., BARANYAI 2008)

It is a difficult task to compare the competitiveness of the two ways, as the conditions are not the same. A future solution can be the combined transportation, by which I mean the well-coordinated use of the two ways of transportation (RoLa-rollende landstrasse-rolling road). The environment loading of the combined transportation is low compared with the road one, it is not competitive with the road on the basis of its economical factors, developments should be necessary. In the question, examined by me, there is no real reality of considering railway by itself a potential competitive factor. This is strengthened by the fact that unfortunately there are some small region centres in the South Transdanubian region which cannot be reached by rail (Tamási, Siklós, Kadarkút). Although I can imagine that the waste, transported on road will be reloaded in a railway junction and it will be transported in a big quantity and more economic form to the destination.

V. FURTHER DIRECTIONS OF THE WORK

The researches, done in the thesis, can be continued in the following directions:

- If we know the change of the quantity of the produced waste, we can establish a trend, with the help of which we can prognose the quantity of potential raw material. Which can be collected in short and long terms (2015, 2025). It can help you to make the civil and regional waste management plans.
- Besides the examination of the effectiveness of transportation, there are several criteria to indicate the field of activity, which were analyzed by MTA FKI experts as well from both natural- and social geography aspect. From the aspects of this latter one it is the 'receiving ability' of the local communities which seems to be the most determining factor, and it would be advisable to examine by a questionnaire survey.
- What is the most interesting for me is the examination of the relation between the urban life style (quality of life) and the quantity of the produced waste per person. It would be advisable to expand the sample area and examine if there is a possibility to make territorial/functional groups on the basis of this aspect.

VI. PUBLICATIONS

1. Publications of the theme of dissertation

BARANYAI G. 2008: *Hulladéktermelés, mint új szempont az életminőség vizsgálatához? (Dél-dunántúli kísérletek)* **Modern Geográfia**, 2008/2. szám, 14 p.

BARANYAI G. 2008: *A települési szilárd hulladékok ártalmatlanításának jogi környezete és annak értékelése.* **Modern Geográfia**, 2008/2. szám, 13 p.

BARANYAI G. – **WILHELM Z.** 2008: *Fenntartható vízkezelési módszerek* In: Tóth J. – Wilhelm Z. – Antal G. (szerk.): *A Balatonról – Lóczy Lajos emlékére.* PTE FDI, Pécs, pp. 107-117.

BARANYAI G. – **CSAPÓ O.** 2007: *Possible Ways of Sustainable Development in the Vend-region.* Spatial Restructing of Slovenia and Neighbouring States: Advantages for Border Regions. In: GOSAR, A. – BUFON, M. – BEGUS, A. – BERDAVS, J. (eds.): *Glasnik zrs Koper.* Vol. 12., nr. 7, Koper, (közlésre elfogadva, a megjelenés ideje: 2009. első féléve), 6 p.

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