



PRESENT AND FUTURE SEWAGE SLUDGE TREATMENT IN HUNGARY AND ITS ENERGETIC UTILISATION

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1. Introduction

Disposal and utilisation of the sludge generated by wastewater treatment causes many problems for operators in Hungary.

The National Wastewater Drainage and Treatment Programme, which started in the wake of the political transition and accession to the EU, is expected to reach completion by 2015.

A direct consequence of the programme is a steady increase in sludge generation as the new wastewater treatment plants come into operation.

At the same time, there is a downward trend in the amount of water supplied in Hungary, as in other advanced countries.

This is the joint result of several factors: economic crisis, falling industrial production, increase in water and drainage charges, and greater environmental awareness.

The average communal water consumption fell below 100 l/person/day in Hungary by the end of the first decade of the twenty-first century.

The quality of municipal wastewater depends in the local structure of habitation, the degree of industrialisation, and consumption habits. This, together with variations in wastewater and sludge treatment, leads to differences in the quality of sewage sludge generated at different sites.

There are 643 working plants, with capacities varying from 300 to 260,000 m³/day.

Small-capacity sites form the majority.

The currently-operating 400 water utilities manage wastewater drainage of more than 400 million m³ each year.

The annual quantity of resulting sludge, assuming average 25-30% dry matter, was 700,000 t/year in 2010. Since the opening of the Budapest Central Wastewater Treatment Plant in 2011, this figure has increased to 900,000 tonnes.[1.]

2. The current position of wastewater sludge utilisation

There is a highly varied pattern of wastewater sludge utilisation and disposal in Hungary.

This is because the country does not have sludge disposal and utilisation strategy tailored to local conditions and economic resources.

As a result, we see the spontaneous emergence of various solutions which do not take account of economic efficiency or future needs.

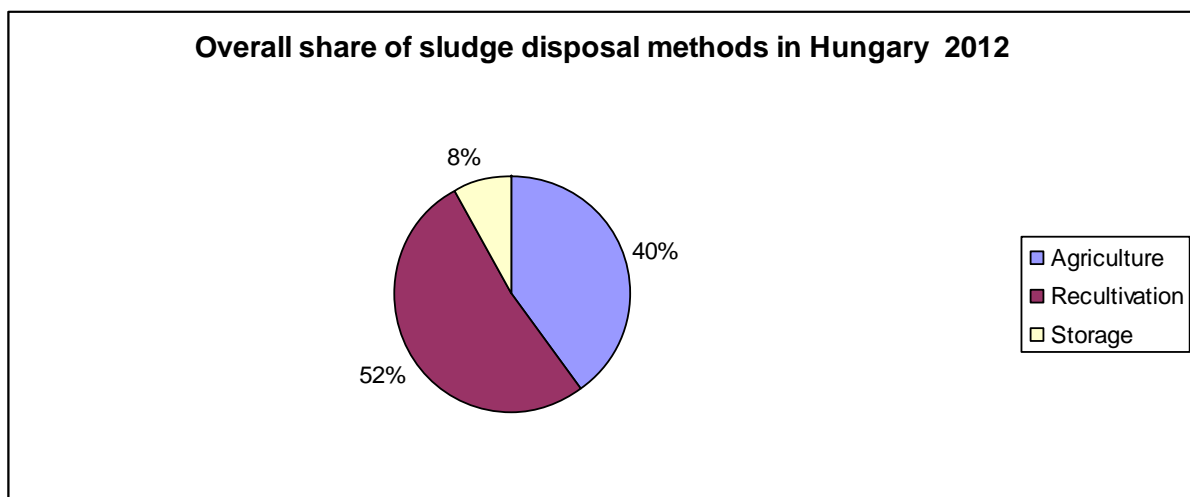
The fertile land of Hungary is excellently suited to agricultural production.

After taking account of disqualifying factors, the country is estimated to have 3 million hectares of land suited to the reception of wastewater sludge.

There is a further 4 million hectares of agricultural land suited to the use of wastewater compost. This is approximately one third of the land area of the country.

A further positive factor is that the sludge generated by Hungary's sewage works is of high quality and conforms to the EU agricultural application criteria. [9.]

Figure 1. Wastewater sludge disposal at 650 sewage plants, 205 000 t Dm/year in Hungary 2012. [3.]



2.1 Agricultural utilisation of sludge

2.1.1 Direct agricultural utilisation of sludge

Only treated sludge may be applied to the land, for which a licence is issued if the landowner consents. The simplest form of sludge treatment is storage for at least six months either thickened at 2-3% dry matter or dewatered at 15-25% dry matter in a watertight reservoir or tank.

This is frequently the method chosen at small-capacity sewage works. Typically, the sludge is transported to larger sites with digesters and appropriate utilisation and dewatering capacity. This arrangement has been in operation in the Budapest area since the building of municipal digesters.

Dilute sludge, without dewatering, is injected directly into the soil. This eliminates the costs of dewatering the sludge and working it into the soil. Its disadvantages are the high cost of transport and the high water content of the sludge. Because of higher resulting from recent changes in fuel prices and ownership structure (reprivatisation), less and less sludge is being used this way.

The costs of disposal are between € 288 and 435 per tonne-dry matter.

This is the cheapest mode of agricultural application, and all sewage sludge used in this way (154,000 m³/year) is applied to arable land to supply nutrients for crops.

The strict framework of legal regulation specifies the quantity of sludge which may be applied without differentiating between soil types.

Sewage sludge compost still does not have realistic market price as a source of plant nutrients, and this impedes its use.

Some landowners are not motivated to use wastewater sludge, and although it is organic fertiliser, there is considerable prejudice against it.

This is also a rising trend in other EU countries.

Experience in Austria, Germany and Switzerland in recent years indicates the reduction of agricultural application or has acted to reinforce a complete ban. [1.]

2.1.2 Composting and agricultural use of wastewater sludge

Composting of sludge is common in large-capacity wastewater works.

The most economic arrangement is to set up a composting facility on site, to avoid transport costs. The main problems here are in subsequent use, but it is a good utilisation procedure if there is a suitable agricultural application.

Composting is used for 40% of the sludge produced each year.

If there are no takers for the compost, however, the operator has to deposit it or send it for recultivation, adding further to costs.

Sludge, the end product of wastewater treatment, contains valuable nutrients and making proper use of it is essential.

If energetic utilisation is not possible owing to the high capital costs or insufficient quantities, then composting is definitely to be preferred.

It could be particularly useful where direct agricultural application is not possible. Its high phosphorous content in particular makes agricultural application preferable to recultivation.

The costs of disposal are between € 250 and 350 per tonne-dry matter.

There could be a discussion here of the P utilisation in agriculture versus chemical extraction from sludge, wastewater or ash [11.]

2.2 Use of sludge for recultivation

This is a widespread application for sludge in Hungary. It essentially involves use as “quasi compost” for covering red sludge and power plant slag storage reservoirs (slurry ponds). The

statistics do not reflect the use of this method, because they incorporate it under composting. It accounts for 52 % of all sludge annually.

The disadvantage of this method is the cost of transport for wastewater works remote from the recultivation area. The new Budapest Central Wastewater Treatment Plant currently disposes of its sludge at such sites. This alone involves approximately 150 000 tonnes of 28-30% dry matter content per year. [2]

The average disposal cost varies, depending on distance, from € 190 to € 550 per tonne-dry matter.

Recultivation should use less valuable material, because the phosphorous content completely drops out of the cycle of use.

2.3 Sludge storage

Storage of wastewater sludge in reservoirs (“cold digesters”) on the treatment plant site is particularly common in the east of Hungary.

It only serves to postpone final utilisation.

Some 8 % of total sludge is put into storage.

This material is not being used at all at present, and will only assume a value in future.

The costs of deposition are somewhat higher than agricultural application and lower than recultivation, but this process unfortunately also entails waste.

For operators who are unmotivated and have not interest in other methods, it is the easy option.

The costs of storage vary between € 50 to € 130 per tonne-dry matter.

The country thus spends € 2240 (HUF 627 million) each year on wastefully disposing sludge which could be used to create value.

3. Energetic utilisation of wastewater sludge

Here I include biogas generation as energetic utilisation, in contrast with statistical classifications, which include this method as a stabilisation procedure within sludge treatment. I will deal only with sludges where biogas is used to generate heat or electric power. The most widespread use of biogas is to reduce the energy costs of wastewater plants. Plants which receive sludge from other sites or waste of high organic content are self-supporting in energy. Budapest No. 2 Wastewater Treatment Plant is one of these, and the Central Plant is 50% self-supporting.

The exhaustion of traditional energy sources, the rise and continual fluctuation of oil prices and worsening environmental problems have forced every country in the world to face the issue of renewable energy.

In order to increase its EU renewable energy quota, Hungary will have to use the energy content of sludge wherever possible.

After extracting the energy from the sludge by fermentation, the stabilised sludge may be used to replace soil nutrients. This is the approach which has made the greatest inroads in sludge treatment in the last 20 years.

Extracting energy from sewage sludge requires considerable capital investment.

Anaerobic treatment is one of the most environmentally efficient technologies.[2.]

Neither does it restrict re-use of phosphorous, unlike combustion in coal power plants or use in cement factories.

The process also eliminates methane emissions from sludge and reduces the quantity of sludge.

The process can generate several different products (biogas, electric power, heating hot water, propellant and organic fertiliser).

The greatest barrier to using the energy from sewage sludge is the relatively high initial capital cost, **not using wastewater sludge = squandering resources.**

But we might also say that **wastewater sludge = grey gold.**

Some examples of biogas developments: City Zalaegerszeg: as fuel for municipal public transport

Table 1. Digesters in wastewater plants and their characteristics

City / plant	Volume of digester (m3)	Gas production m3/d	Method of utilisation
Budapest Észak	2 x 12 000	27 500	Electric power generation to cover the energy requir. of the plant
Budapest Dél	4 x 2 600 és 1 x 2000	27 000	Electric power generation to cover the energy requir. of the plant
Budapest Központi /Main /	3 x 5800	23 000	Electric power generation to cover the energy requir. of the plant
Debrecen	2 x 4 500	6 500	Electric power generation to cover the energy requir. of the plant
Kecskemét	1 x 2460, 2 db. 1350	3 000	Electric power generation to cover the energy requir. of the plant
Szeged	2 x 4000	4 000	Electric power generation to cover the energy requir. of the plant
Veszprém	1x1000, 1x 1500	2 500- 3 300	Electric power generation to cover the energy requir. of the plant
Sopron	2 x 2 200	2 500	Electric power generation to cover the energy requir. of the plant
Szombathely	2 x 2 500	3 000	Electric power generation to cover the energy requir. of the plant
Zalaegerszeg	2 x 1 540	1 000-1 200	Electric power generation to cover the energy requir. of the plant and CNG for transport
Győr	2 x 3 750	6 000~	Electric power generation to cover the energy requir. of the plant
Összesen		107 500	
Kapuvár		under construction	

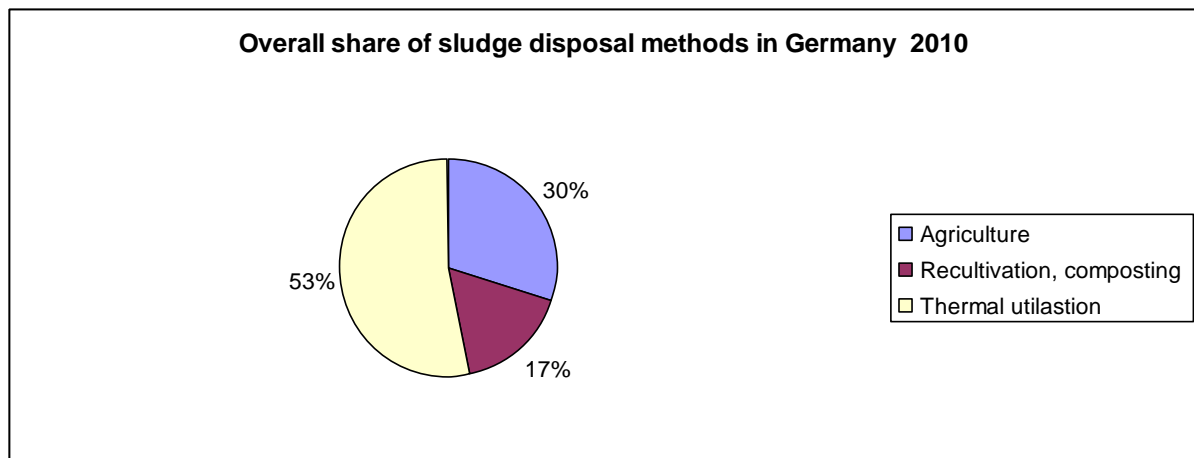
Establishing biogas plants based on communal wastewater sludge is primarily a task for the central- and local-government sectors.

The gas or electric power generated can be used to cover the energy requirements of the plant itself.

4. Energetic utilisation in Hungary in the European perspective

No sludge is incinerated or used in cement works in Hungary at present. This form of use has received no government support in recent years, in fact it has been out of favour. There are test or experimental operations in several plants, but for various reasons they have not been taken further. By comparison, thermal utilisation in Germany has increased from 9% to 40% of the total in the last 20 years.[11.]

Figure 2. Wastewater sludge disposal in Germany

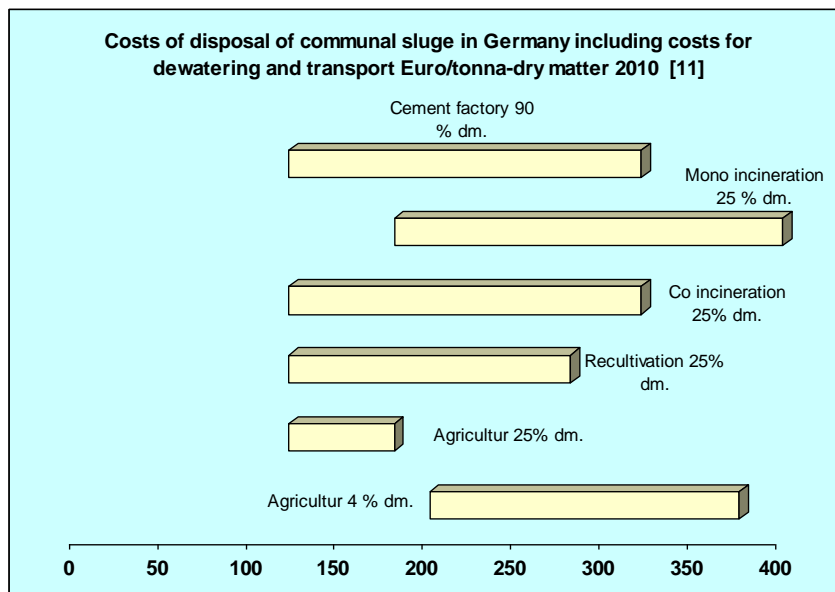


In Germany the proportion of the thermal utilisation attained the 53 %, the recultivation decreased to his half during this: 16 % . The proportion of the agricultural utilisation did not change : 30%.

The causes may be traced to the National Wastewater Programme, which was launched following the country's EU accession in 2004 and concerned with developing municipal drainage and sewage treatment. No attention or resources were devoted to the possibility of municipalities cooperating to build joint thermal utilisation plants. Incineration of small quantities of sludge would not be economic. A potential opportunity was the construction of the new Budapest Central Wastewater Treatment Plant, Central Europe's largest EU-supported environmental project, with a nominal capacity of 350,000 m³ per day. Digesters were built, but without thermal utilisation.[2]

The comparison of the cost of disposal

Figure 3. Cost of disposal in Germany

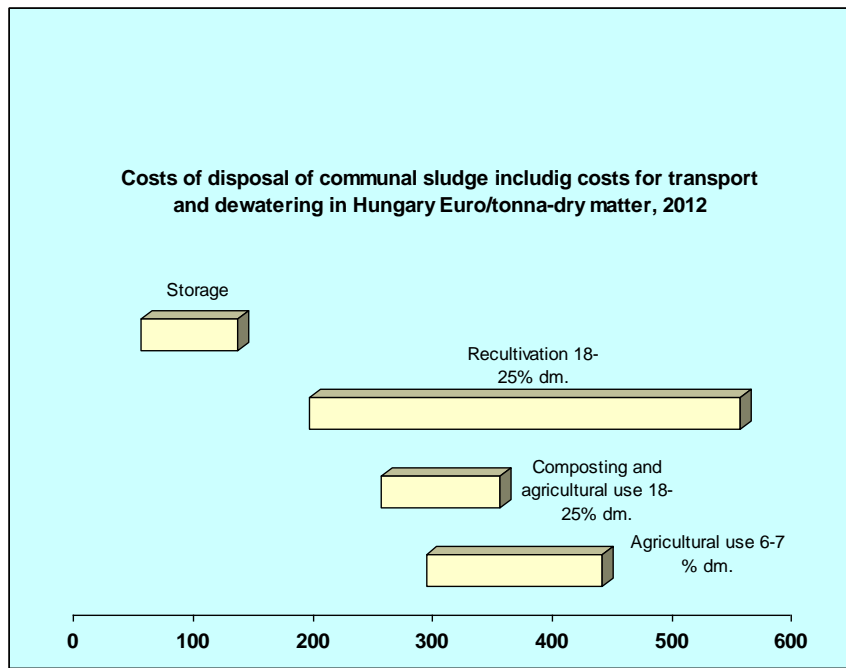


If we compare the expenses of disposal, we manage to get onto a surprising result. The price level attains or exceeds expenses in Germany without energetic utilisation of the sludge.

The highest mono incineration costs not exceeds € 400 per tonne-dry matter in Germany at the same time the cost of recultivation more then € 550 per tonne-dry matter in Hungary.

Onto the comparison of the expenses of disposal we used the data of Federal environment protection office. [11]

Figure 3. Cost of disposal in Hungary



4. Summary

Inescapable that let the thermal utilisation of the sewage sludge receive a bigger role opposite the recultivation in the future. The proportion of the agricultural utilisation will not decrease.

It is a widespread experience in EU countries that tightening regulations stimulate increasing energetic utilisation of sewage sludge.

The essence of EU energy policy, in pursuit of sustainable development, is to make renewable energy competitive.



There are 16 sewage treatment plants in Hungary which implement biogas generation with anaerobic treatment, and 11 of these use it to generate electricity

They use the electricity to supply their own needs.

The generating capacity is approximately 9.2 MW. [2] If we compare the expenses of disposal, we manage to get onto a surprising result.

The price level attains or exceeds expenses in Germany without energetic utilisation of the sludge and burdens the prize of the service.

The new Hungarian National Waste Management Agency now supervises the collection, transport and utilisation of domestic waste. Considering that wastewater sludge is a secondary raw material of no less strategic importance than domestic waste, there seems to be a good

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argument of its utilisation to be put under the supervision of new Water Utilities Authority, which is responsible for setting charges and overseeing investments.

It would be necessary to carry out an analysis of present means of utilisation set against developments in Europe, and to make a proposal for further action.

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