Benchmarking of Large Municipal Wastewater Treatment Plants Greater Than 100,000 PE in Austria

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INTRODUCTION

Benchmarking is the continuous comparison of products and services, processes and methods of various enterprises in order to minimise the gap to the "best practice" (Gabler, 1997).
The Austrian Benchmarking System was developed during a six-year period (1999 – 2004). Since 2004 this system has been operated via an internet platform and automated to a large extent. Every year twenty to thirty treatment plants use the web-based access to this benchmarking platform. The Austrian Benchmarking System for treatment plants is unique as it is performed in a close co-operation of the Austrian Water and Waste Association, two private consulting companies ("k2W" for technical and "Quantum" for economic data processing and information transfer) and the Institute for Water Quality, Resources and Waste Management from the Vienna University of Technology responsible for quality assurance and development. The main objectives of this benchmarking system are the development of performance indicators, identification of best performance and determination of cost reduction potentials.

METHODOLOGY

Following the timeline of a benchmarking year the benchmarking procedure can be sub-divided into i) data acquisition, ii) data processing comprising data evaluation, calculation of performance indicators and reporting and iii) organized exchange of experience for the treatment plant managers.
In order to be able to compare the performance of different treatment plants wastewater treatment has to be divided into four well-defined main processes 1) influent pumping and mechanical pretreatment, 2) mechanical-biological treatment, 3) thickening and stabilization, 4) further sludge treatment and disposal, and two support processes I) obligatory and II) optional. For large wastewater treatment plants (WWTPs) these processes are further split up into sub-processes. For each (sub-)process the operating costs are attributed to six cost categories. The specific total yearly costs and the yearly operating costs of all (sub-)processes are related to the measured mean yearly pollution load on the plant expressed in population equivalents (PE_{110}: 110 g COD/d corresponding to 60 g BOD_5/d). The specific capital costs are related to the design capacity (PE). In order to become a benchmark plant for the yearly total and the yearly operating costs a WWTP has to achieve the lowest specific total operating costs, meet the Austrian effluent standards, achieve a minimum quality of technical data and moreover, there should not be a dominant industrial influence.

RESULTS AND DISCUSSION

This shows the benchmarking results of six Austrian plants with a design capacity greater than 100,000 PE representing approximately 30 % of the Austrian municipal WWTP capacity.

The total yearly costs of the benchmark are 23.2 €/PE_{110}. The lowest specific operating costs (benchmark) amount to 9.1 €/PE_{110}/a and the yearly capital costs to 8.5 €/PE design capacity. In a more detailed cost analysis the operating costs are assigned to six processes. Results show that the process *sludge treatment and disposal* costs 4.3 €/PE_{110} (median) which is more than 40 % of the total operating costs. The second largest expense factor is the *obligatory support process I*, comprising laboratory, administration and infrastructure. The process *mechanical-biological treatment* which is the key process for water protection costs approximately 1.5 €/PE_{110} /a (median), i.e. less than 15 % of the total operating costs. Process 1 and process 3 are even less relevant with costs below 1 €/PE_{110}/a. The optional support process II (workshop and motor pool) can generally be neglected.
Figure 1 shows the proportion of the total operating costs for the six cost categories.

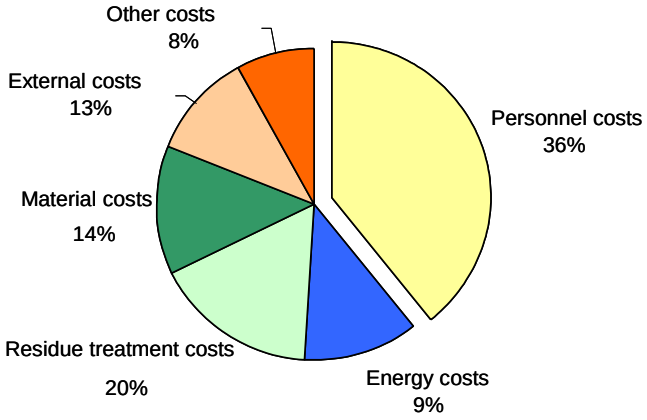

Figure 1 Distribution of cost categories as percentage

The major proportion is personnel costs, followed by residue costs which play a significant role for sludge treatment and disposal. Energy costs amount to less than 10 % of the operating costs, however, several factors such as energy consumption and production from biogas can have a great impact on this category. The investigated WWTPs are characterized by low yearly energy consumption between 20 and 30 kWh/PE_{110}.
A technical indicator with a high impact on the specific operating costs is the plant utilization (ratio between the 85th percentile of the yearly COD-load and the design capacity) since 50 to 65 % of the total operating costs are independent of the actual COD-loading. Specific operating costs below 10 €/PE_{110}/a can only be achieved with a utilization above 80 %.

CONCLUSION

For large waste water treatment plants continuous benchmarking represents a powerful management tool. The internet-based benchmarking platform has facilitated economical data management and information transfer between the treatment plant operators and the technical and financial experts. It enables the managers and operators to find and realise cost reduction potentials. By the comparison with the benchmarks and by information exchange amongst the treatment plant managers it is possible to increase cost-efficiency relation. However, benchmarking is not only a tool to enhance cost-efficiency, but offers the opportunity to prove excellent performance of treatment plant operation.

REFERENCES

Gabler Wirtschaftslexikon (1997). 14th edn, Gabler, Wiesbaden.