

OPERATION COSTS OF WASTEWATER TREATMENT PLANTS

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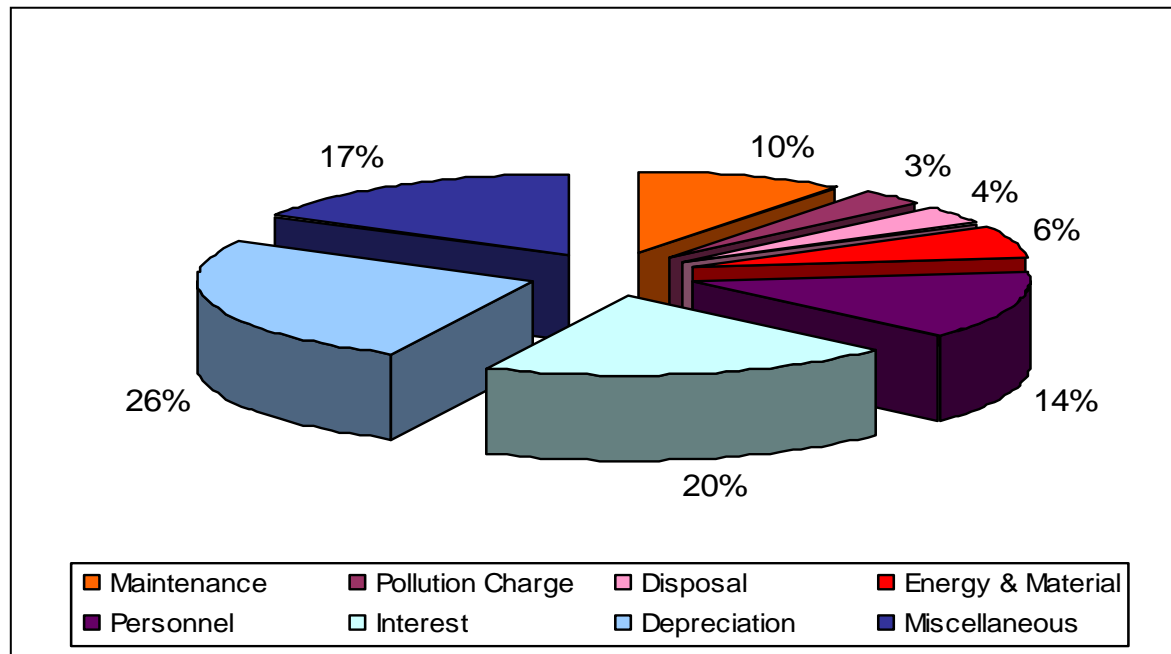
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Operation Costs in Relation to Total Annual Costs

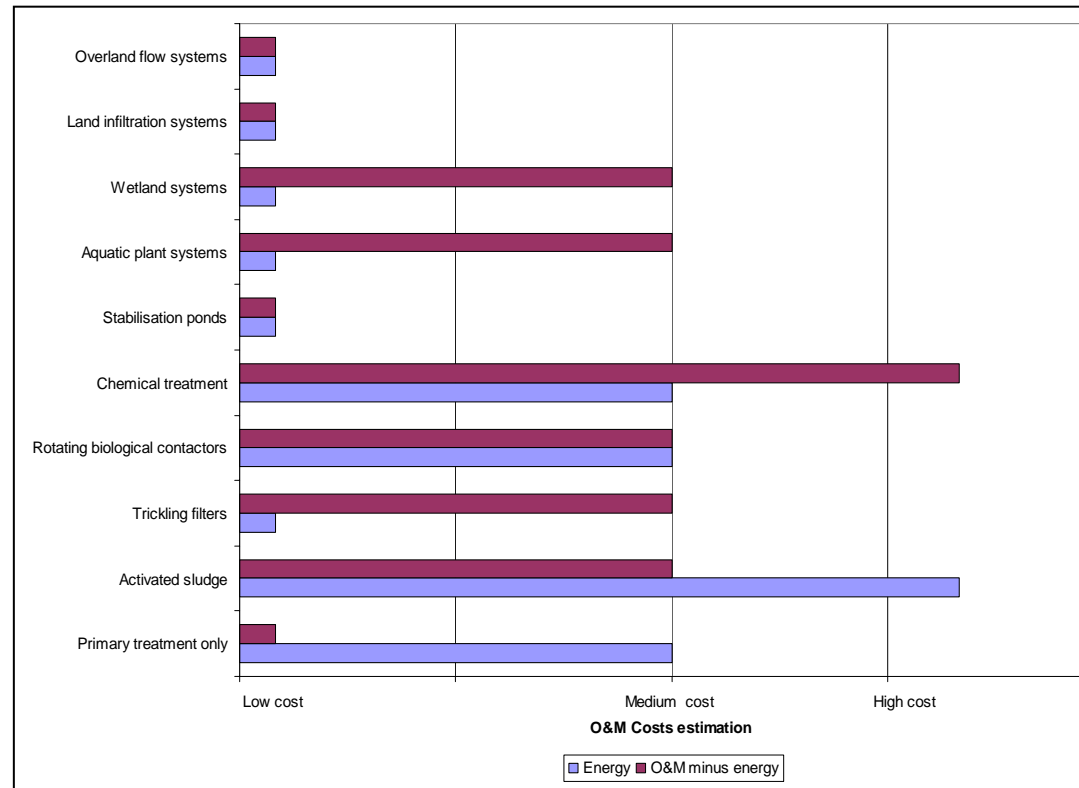
- Operation costs are the expenses related to the operation, maintenance and monitoring of the plant
- Operation costs can amount up to 50 % of the total annual costs.
- The evaluation of operation costs during the evaluation of process alternatives is of crucial importance.

Composition of total annual costs for wastewater systems in Germany [ATV, 2003]



Factors affecting Operation Costs

- Size and load of the plant
- Topography and geographical situation of the site (affecting pumping energy costs)
- Characteristics of wastewater and the discharge norm
- Technologies and the selected treatment process
- Type of sludge treatment and way of disposal
- Energy supply and energy recycling
- Degree of automation, measurement and process control
- Organization of the plant and its management



Comparison of operation costs O&M for different types of secondary treatment options [Kampet, 2000]

Personnel

The major parameters that influence the number of operational staff employed are:

- the size of installation,
- the treatment processes and systems,
- the degree of automation,
- productivity efficiency of personnel,
- managerial efficiency and
- others.

Personnel costs subject to the treatment capacity of wastewater treatment plants [Reicherter, 2003].

< 10.000 p.e.	35 – 40 % of total operation costs
10.000 – 100.000 p.e.	25 % of total operation costs
> 100.000 p.e.	15 % of total operation costs

Maintenance

The costs for maintenance of wastewater treatment plants usually amount up to **15 – 25 %** of the total operation costs.

Civil Constructions

0.5 – 2.0 % of investment costs per year

Renovations of Civil Constructions

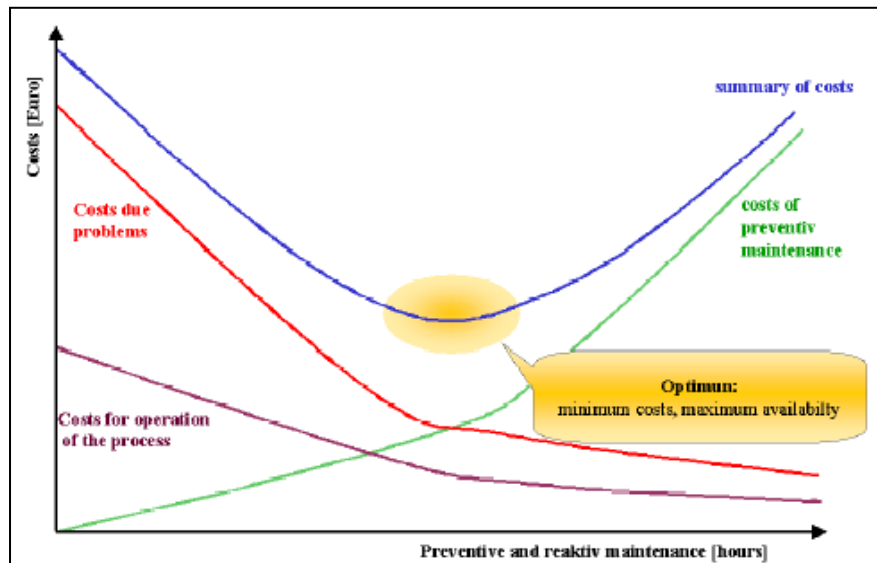
2.0 – 4.0 % of investment costs per year

Mechanical Equipment

2.0 – 6.0 % of investment costs per year

Electrical and Electronical Equipment

2.0 – 6.0 % of investment costs per year

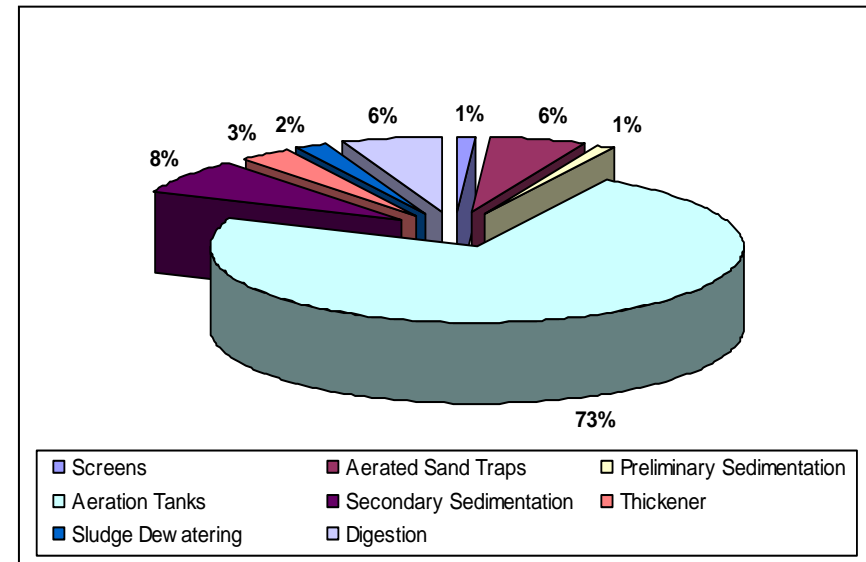


Costs and maintenance seen as a whole; the optimum is achieved from the best relationship between costs and availability [Müller, 2003]

Energy

The costs for energy usually amount up to **10 – 30 %** of the total operation costs.

- Pumping Stations 10 – 15 Wh /m³
- Screens 0.3 – 0.5 kWh / (p.e. &.a)
- Aerated Sand Traps 1.7 – 2.2 kWh / (p.e. &.a)
- Prel. Sedimentation Tanks 0.4 – 0.6 kWh / (p.e. &.a)
- Aeration Tanks 17.2 – 25.8 kWh / (p.e. &.a)
- Sec. Sedimentation Tanks 1.2 – 2.3 kWh / (p.e. &.a)
- Thickener 0.7 – 1.1 kWh / (p.e. &.a)
- Sludge Dewatering Devices 3.0 – 4.0 kWh / (p.e. &.a)
- Digestion 2.4 – 2.9 kWh / (p.e. &.a)



Composition of energy demand for different process components of wastewater treatment plants [Bohn, 1993]

Disposal

The costs for disposal consist of the disposal of sewage sludge, screenings, sand and municipal waste. The disposal costs can differ between **15 and 50 %** of the total operation costs.

Generally, disposal costs depend to a large degree on

- the size of the treatment plant,
- national regulations for the disposal of organic materials like sewage sludge,
- local conditions and market price conditions respectively.

Practical experience with sludge disposal in different European countries (S, DK, G, F, CH) can be summarized as follows:

- For the very large number of small treatment plants (e.g. <20.000 PE) landspreading / agricultural use of sewage sludge seems to be the most economical and sustainable solutions as long as source abatement of possibly hazardous substances is successful. Landspreading of semi-solid and landspreading of solid sludge entail on average the lowest total cost.
- Landspreading of composted sludge, use of sludge in land reclamation and use of sludge in silviculture record intermediate total costs.
- Landfilling, mono-incineration and co-incineration of sludge with other wastes entail the highest costs.

Chemicals and Material

The costs of chemicals and materials usually range between **5 – 7 %** of the total operation costs.

The costs mainly depend on the characteristics of wastewater and the discharge norm, the selected chemicals, correct dosing, quantities kept in stock and purchasing deals.

The market situation and the price structure for chemicals differ strongly.

- Polymers, alum and lime for sludge conditioning
- NaCl, Cl₂, O₃ for disinfection
- FeCl₂, FeCl₃, AlCl for precipitation of phosphorous
- Methanol, ethanol for denitrification
- Reagents for laboratories
- Oil and gas for machinery and vehicles
- Others

Miscellaneous

Miscellaneous costs can differ between **5 and 15 %** of the total operation costs.

If pollution charges have to be paid to the authorities, pollution charges are the main contributor to the total miscellaneous costs (4 - 8 %).

- Internal laboratory services
Self-monitoring and analysis of water authorities
- Pollution charges
Pollution charges are often levied by local or national governments on the discharge of water into the environment. There is a variety of charging systems into place to determine the pollution charges on wastewater discharge. For treatment plants the pollution charge is often calculated based on the number of inhabitants served by the plant or the pollution load of specific chemical, biological and biochemical parameters.
- Administrative costs like insurances, office equipment etc.
In some municipalities administrative costs are paid centrally, in some these costs are allocated to the wastewater treatment plant.
- Rents and tenancies
Some municipality own their land and buildings and have these costs on their capital budget. Others pay rents and tenancies.
- External costs for consultants, maintenance works, laboratory analysis