

# The Swiss Benchmarking Initiative for the Water Services

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## Abstract

Due to the fact that in Switzerland water is normally produced and distributed by small and middle size water companies, a special benchmarking concept had to be developed. System costs, operation and maintenance, rehabilitation and financing were of special interest. It was seen that the relevant factor of influence for overall costs is the specific transmission input per distribution mains length. Overall costs in Switzerland are dominated by water distribution, not by water production. Concerning operation and maintenance there are many different strategies and priorities in Switzerland. Hence, these processes often have a high optimization potential. Based on simulations it could be shown that about half of the Swiss water works already have a sound financial basis for future challenges. Due to the success of the project, it will be repeated, but with a slightly reduced number of performance indicators.

## Keywords

Benchmarking, drinking water, performance indicators, water supply

## INTRODUCTION

Besides some rather big water companies more than 3'000 small and middle size water works serve the Swiss population. In order to improve the efficiency and transparency of the Swiss water services, the Swiss Gas and Water Industry Association (svgw) started a Swiss Benchmarking Initiative. It was the aim to establish a benchmarking-concept which takes into account the particularities (many small and middle size companies, limited financial data of single sub-processes) of the Swiss water services. Both the water services and the svgw should profit from the benchmarking project. The major topics of the Swiss benchmarking initiative were:

- standardized costs of water abstraction and treatment, distribution (transmission and storage included), management and technical services functions
- abstraction and treatment of water
- operation and maintenance of water distribution
- rehabilitation and enlargement
- quality
- comparison with IWA-performance indicators

## METHODS

The concept of the project procedure is based on the experience with other infrastructure benchmarking projects (Hug et al., 2002; Matos et al., 2003; Kappeler et al., 2003; Dechant et al., 2004; Wittig et al., 2004; Hirner and Merkel, 2005; Wichmann et al., 2005; Kappeler et al., 2006). All relevant details such as performance indicators, factors of influence, relevant strategies and data specification were discussed with experts of the involved water services in advance.

The participants collected all the necessary information, mainly of the year 2007, based on a questionnaire. Additionally the participants were assisted by the consultants.

All data used were systematically controlled by a plausibility routine which consists of water and cost balances and a limited set of performance indicators. Questionable data were additionally checked at a plausibility-workshop.

In order to achieve representative findings the performance indicators are specified by different factors such as water consumption, water production capacity, length of the distribution system and others.

For the evaluation of the personal costs, the internal manpower costs were collected and then normalized by CHF 60 per hour. With this procedure the influence of different salary systems and levels was eliminated.

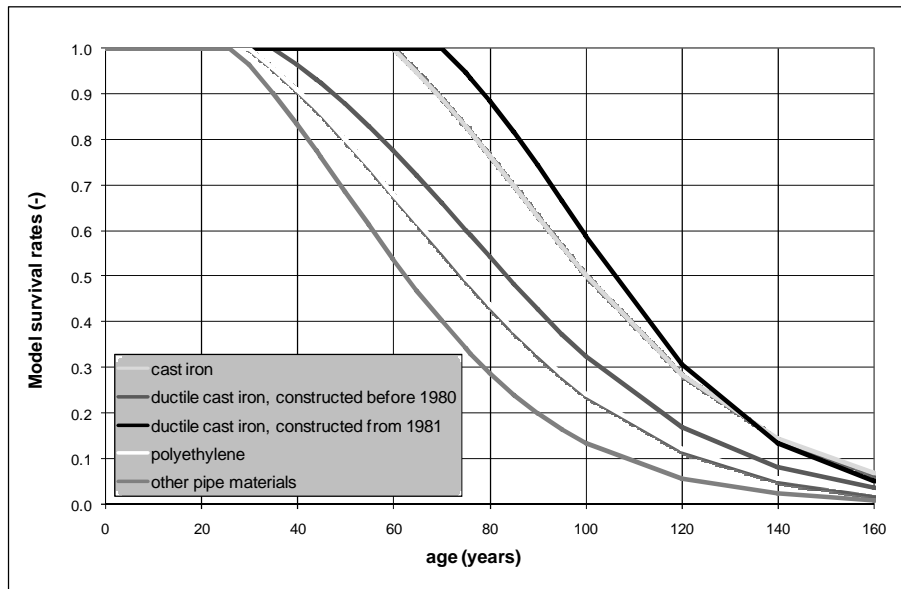
In order to get reliable capital costs, a simplified register of assets was elaborated for all the participants. Hence, year of construction, construction and replacement costs and the relevant assets are known for all water companies. Different regional price levels among the distribution systems were eliminated by normalized replacement costs of CHF 750 per meter.

For all discussions on costs, capital costs were calculated based on the actual replacement costs. The depreciation periods which are generally used in Switzerland (svgw, 2009), are shown in Tab. 1. Interest costs are calculated with 4% on half of the replacement values.

**Table 1:** Depreciation periods of assets in the Swiss water industry

Assets	Depreciation period
Mains and service connections (ductile cast iron, constructed before 1980)	70 years
All other mains and service connections	80 years
Spring water facilities	50 years
Treatment plants	33 years
Pumping station of ground-water, construction	50 years
Pumping station of ground-water, electromechanical equipment	25 years
Pumping stations, construction	50 years
Pumping stations, electromechanical equipment	25 years
Reservoirs	60 years

The analysis of the revenues and the discussions on the financial development of the water companies are based on the construction costs. The necessity for mains rehabilitation is calculated based on the concept of survival rates (Herz 1996, Herz 1999) with the assumptions which are presented in Fig. 1. An interest rate of 4% is applied to half of the replacement costs as well.



**Figure 1:** Assumptions of survival rate parameters for different mains

All the figures showed below are sorted based on the amount of produced water.

Among the participants all the information and results were discussed in an open way. But all kind of publication such as information of the public etc. was strictly kept anonymous.

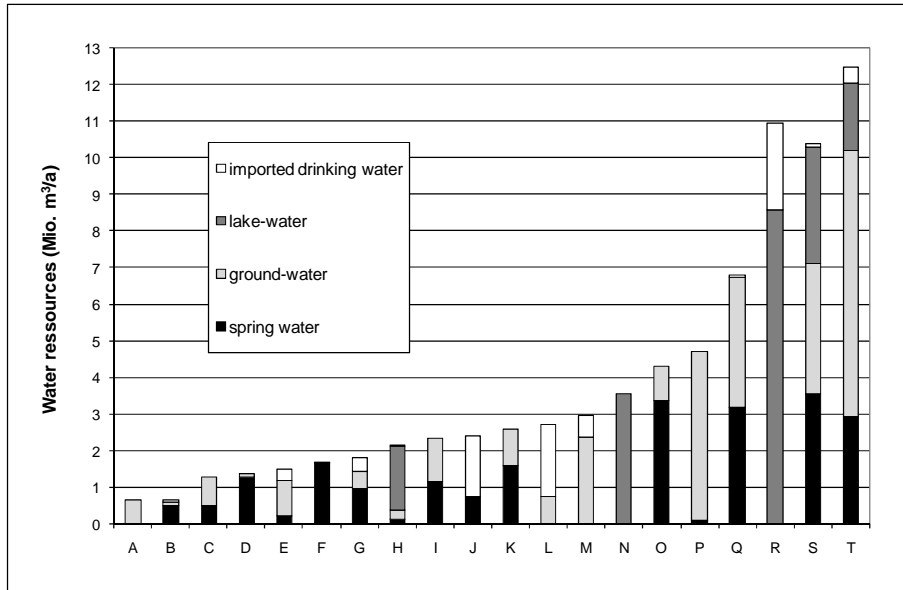
## RESULTS AND DISCUSSION

### Participating water companies

Twenty water companies, which serve between 5'000 and 100'000 inhabitants and about 0.5 million in total, took part in the project. Hence, nearly 10% of the Swiss population is indirectly involved in the benchmarking project. About 30% of the produced water is spring water, 40% ground-water and 30% lake-water (Fig. 2).

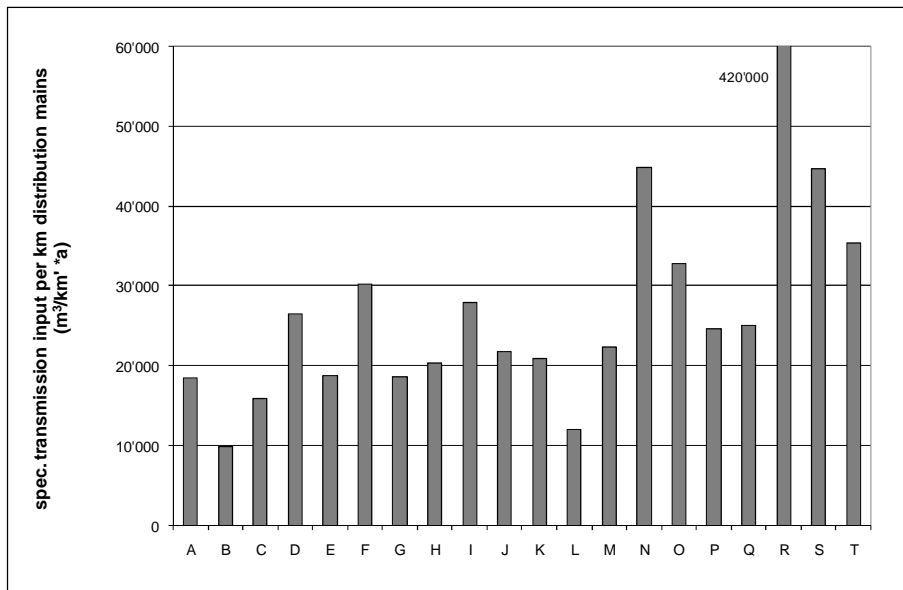
Discussing overall costs the specific transmission input per km distribution mains is the most important factor of influence. From Fig. 3 it can be seen that the specific transmission input per km distribution mains varies by a factor of 4 (strong influence of the different systems with their assets and of industrial customers).

The capacity utilization rate of the abstraction and treatment facilities is for most water services between 20 and 40%. Hence, large free capacities are often the case in Switzerland.



**Figure 2:** Water resources

Corresponding to a strongly decentralized country the composition of the revenues varies a lot among the different water services. In most cases  $m^3$ -related charges are the most important elements of the revenues.



**Figure 3:** Specific transmission input per distribution mains length

The composition of the distribution mains is shown in Fig. 4. Cast iron, ductile cast iron and polyethylene were often used in Switzerland in the past.

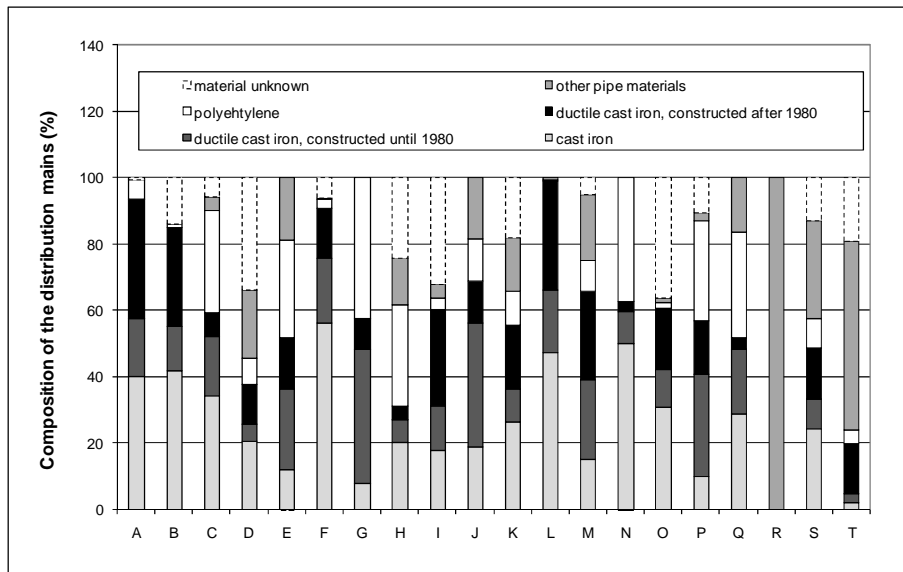


Figure 4: Composition of the Swiss distribution mains

### General findings

Besides the individual results some common findings were seen. Abstraction and treatment of water is very heterogeneous in Switzerland. These differences represent factors which hardly can be influenced. In general larger water companies have a higher treatment standard. Nevertheless the overall unit costs of larger water services seem to be slightly smaller than the ones of smaller water companies (Fig. 5). This trend is caused by the generally higher specific transmission input per km distribution mains of large water companies and the fact that the costs of the distribution system dominate the overall costs.

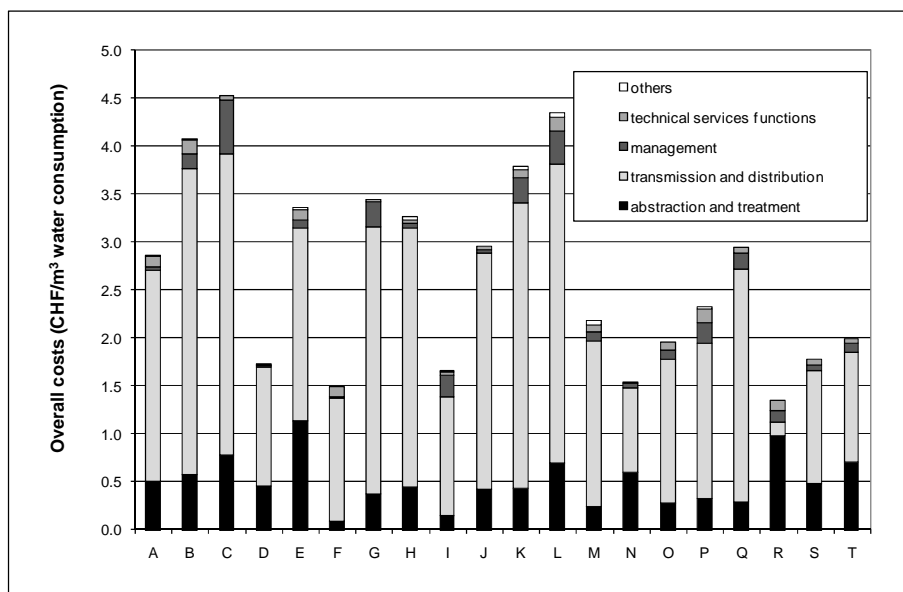
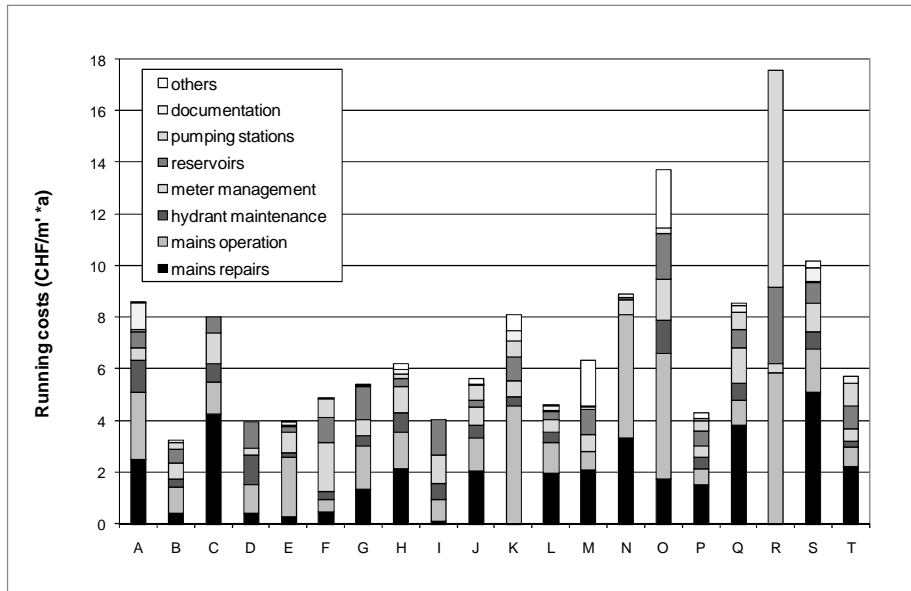


Figure 5: Overall costs of Swiss water companies

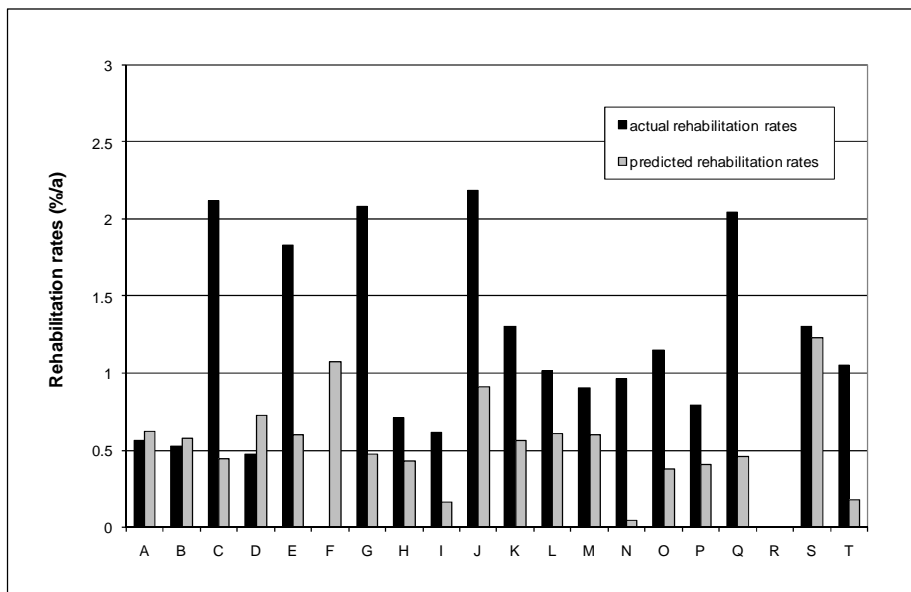
The average costs of abstraction and treatment are about CHF 0.40 per m<sup>3</sup>. Most important factors of influence are the degree of treatment (no treatment or only disinfection versus conventional treatment), raw water quality, the number of catchments and obviously capacity utilization.

The assumption that different water services apply different quality standards was confirmed. But from Fig. 5 follows that higher quality does not lead to significant higher costs. Hence, management and technical services functions are generally not cost relevant compared to water production and distribution.



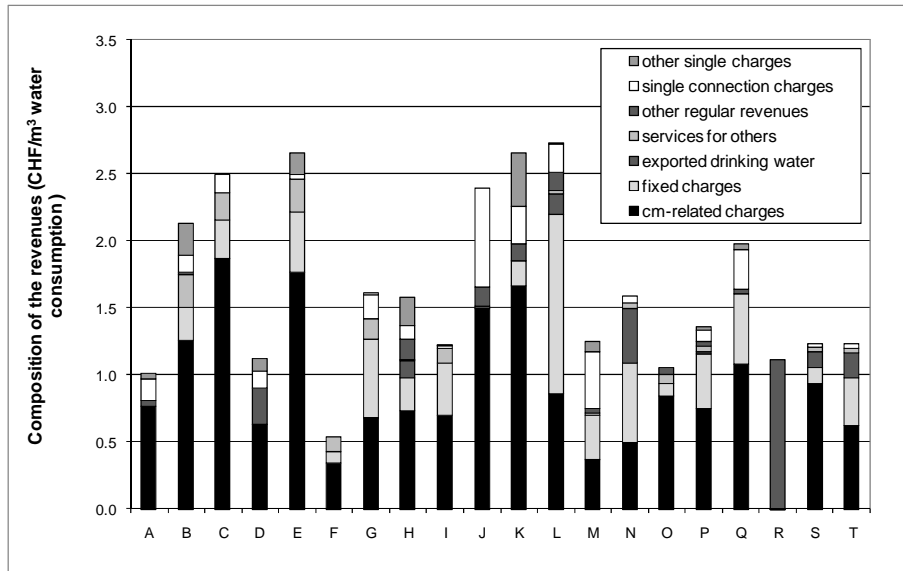
**Figure 6:** Running costs of water transmission and distribution

From Fig. 6 it can be concluded that the different water companies use different strategies and priorities for operation and maintenance of the distribution systems. In general mains repairs and operation are the most cost relevant sub-processes. Due to the considerable variations in costs, operation and maintenance represent a major optimization potential for most of the water services.



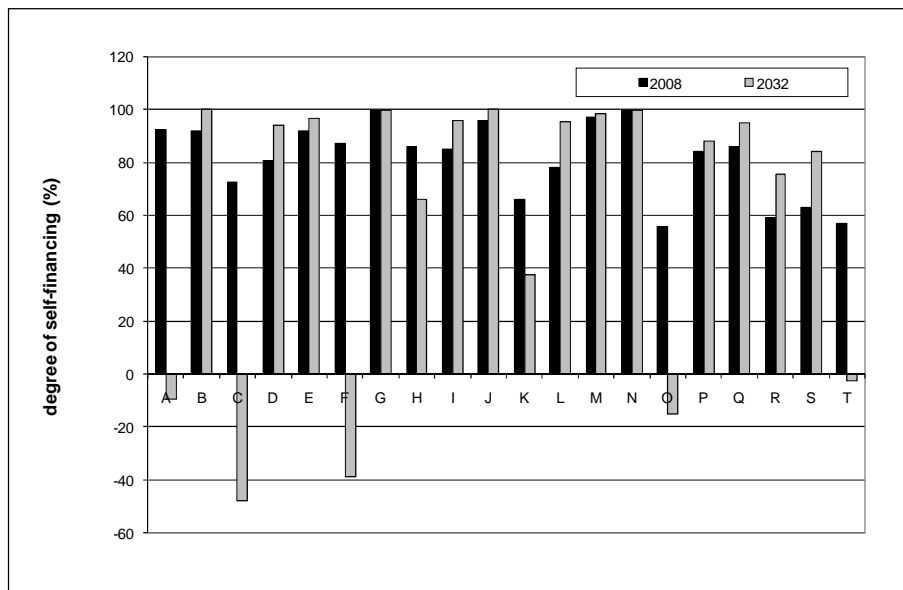
**Figure 7:** Actual and predicted rehabilitation rates of mains

The real rate of mains rehabilitation was discussed and also compared with the results of mathematical simulations, based on the individual mains composition and typical survival rates for different groups of materials (see Fig. 1). For most of the water companies a theoretical rehabilitation rate between 0.5 and 1.0%/a was predicted. This rate fits very well with the actual rehabilitation rate of the companies as long as no major rehabilitation had to be carried out due to electricity-, gas- or road-works (Fig. 7).



**Figure 8:** Composition of the revenues

The financial basis of each water company was analyzed as well. Actual and future revenues (Fig. 8), investments, operational and interest costs were taken into account. Fig. 9 represents the development of the degree of self-financing over the next 25 years. The simulations show that with the actual revenues about half the Swiss water works already have a sound financial basis for future challenges.



**Figure 9:** Degree of self-financing over the next 25 years

## **Individual results**

With all water companies the results were discussed individually. The most relevant findings normally concerned both strategy and aspects of operation and maintenance. For water company O for example, it could be shown that the industrial customer plays a vital role among the consumers and therefore deserves special attention. The storage capacity of 0.5 days is short and should be enlarged. The revenues are too small and the basic charges should be increased. Concerning operation and maintenance it was pointed out that the workers do their job very carefully, but that a significant reduction of the frequency of network, valve and hydrant inspection should be taken into account.

## **Comparison with German water works**

The comparison with German water works, based on IWA-performance indicators, showed that the average daily specific water consumption by households in Switzerland of about 210 liters per inhabitant is relatively high. This is a clear consequence of the fact that the amount of basic charges is relatively high in Switzerland. On the other hand financing of future infrastructure projects is also guaranteed at decreasing water consumption.

The running costs of abstraction and distribution are slightly higher in Germany than in Switzerland. This might be a consequence of the need for a higher standard in water treatment. Concerning standardized internal manpower costs no significant differences were observed among Swiss and German water companies.

## **CONCLUSIONS**

Due to the benchmarking project the water services could gain a lot of findings about their own company and the way, how processes are carried out by others. As a next step the recognized optimizations have to be realized.

The results proofed that the concept of the Swiss Benchmarking Initiative is appropriate for the Swiss water industry. The initially mentioned aim was achieved. In order to facilitate data collection the number of performance indicators will be reduced in future projects. Because benchmarking is an ideal management tool for the water companies, the svgw will support the application of the Swiss Benchmarking Initiative in the future.

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