

# Efficiency Increase of Sewage Treatment System in the Trend of Depopulation

(Study period: Fiscal 2015 and 2017)

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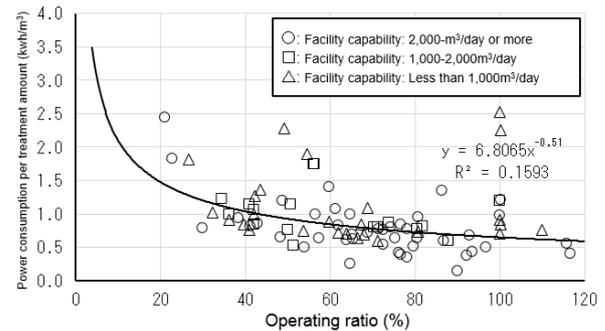
*Key words: sewage treatment system, depopulation*

## 1. Introduction

Sewage treatment system includes sewerage, agricultural community effluent, human waste treatment facilities, etc. Local governments have adopted their sewage treatment systems according to the characteristics of their regions. Since sewage treatment systems have the issue of decline in the operating ratio (i.e., treatment amount / capability of the facility) and profitability of treatment facilities due to the decrease in the required performance of facilities and utility income as a result of reduced amount of sewage treatment in accordance with population decrease and to the increase in the cost of reconstruction / renewal of aged facilities, etc., NILIM has been studying the efficiency increase of sewage treatment system under the condition of a decreasing population.

## 2. Maintenance cost considering operating ratio

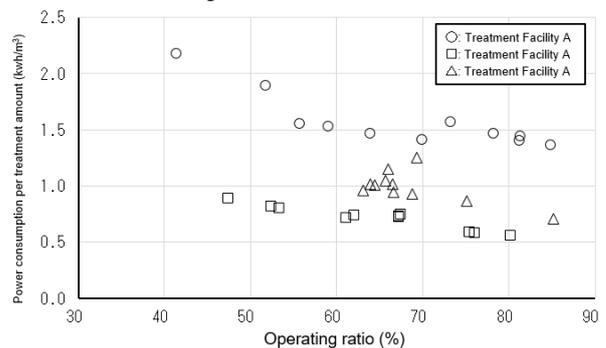
The existing literature includes some studies on cost functions concerning the maintenance of sewage treatment systems but none of them considers depopulation. This study examines maintenance cost considering the operating ratio, which varies year by year due to depopulation, in order to compare maintenance cost based on life cycle cost. First, we conducted a survey on actual maintenance cost for the latest one year about sewage treatment facilities across the country (111 sewerage facilities, 78 agricultural community effluent facilities, and 72 human waste treatment facilities). Figure 1 shows an example of the sewerage system for which the relationship between power consumption and operating ratio concerning the facility operation based on the treatment amount that is significantly affected by operating ratio. In general, when operating ratio is high, the operating efficiency of the facility is good and power consumption per treatment amount becomes small because treatment close to the facility's capability is possible. This trend can be also confirmed in Figure 1, the coefficient of determination ( $R^2$ ) of the approximate expression in the graph is approx. 0.16, and the correlation is low. The result was the same for agricultural community effluent and human waste treatment facilities. The reason for no appearance of the effect of operating ratio in the results would be the variety of the quality of inflow water, operating method, introduced equipment, etc. in the treatment facilities surveyed across the country. The results of this fact-finding survey also suggest that no items other than power consumption are affected by operating ratio.



**Figure 1: Relationship between power consumption per treatment amount and operating ratio (sewerage)**

Next, we organized the relationship between the power consumption per treatment amount for the past decade in the same treatment facilities and operating ratio in order to remove factors other than operating ratio to the extent possible. Figure 2 shows an example of the results of organization.

We are organizing the calculation methods of the maintenance cost based on operating ratio, considering power consumption per treatment amount according to changes in operating ratio and ratio of change. We are also organizing the assessment procedures and methods in technical and environmental aspects in addition to cost aspect.



**Figure 2: Relationship between power consumption per treatment amount in the same treatment facility and operating ratio (example of sewerage)**

## 3. Future development

NILIM will promote the efficiency increase in sewage treatment systems in the trend of depopulation by preparing technical material for local governments to study / evaluate efficient sewage treatment systems in their regions.