Efficiency Increase of Sewage Treatment System in the Trend of Depopulation (Study period: from Fiscal 2015 to 2017)

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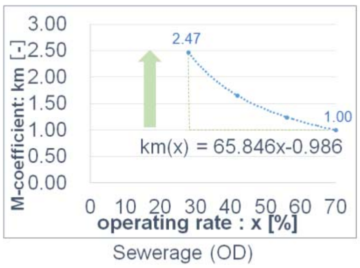
Keywords: sewage treatment system, depopulation

1. Introduction

Sewage treatment systems include sewerage, agricultural community effluent, human waste treatment facilities, etc. Due to a decrease in the service population and subsequently its sewage inflow, the sustainability of the service is now in jeopardy since the operating efficiency of the facilities with lower inflow volume than the designed capacity could decline significantly and the revenue from user-fees would also be decreased, while still investments in the reconstruction / renewal of aged facilities would be required in the near future. Hence, NILIM has been conducting research on efficient (sustainable) wastewater treatment systems in a population declining society.

2. Maintenance cost prediction considering operating rate

The trends in the unit of maintenance costs due to the differences in the operating rate were arranged as the coefficient (M-coefficient), based on the published operation records and questionnaire surveys of each system. Consequently, the maintenance coefficient increased as the operating rate declined in each facility (see Figure 1).



* M-coefficient [-] = (Unit of maintenance cost at a certain operating rate x) (JPY/m3) ／(Unit of maintenance cost at the maximum operating rate(70%)) (JPY/m3)

Figure 1: Relationship between the operating rate and the maintenance coefficient (Sewerage: OD method)

3. Optimization method for sustainable wastewater treatment systems

We developed a method for selecting sustainable wastewater treatment systems based on comprehensive viewpoints including the economical, technological and environmental factors. (Figures 2 and 3 and Table show study cases.) We conducted validation by studying model cases in actual cities and summarized results of validation as evaluation method.

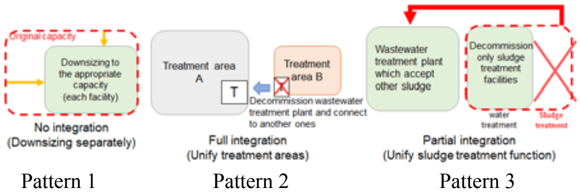


Figure 2: Representative integration scenarios

Table: Example of trial optimization result (in virtual city)

Factors		scenario 1	scenario 2	scenario 3
Overview		Downsizing A and B separately (no integration)	Unify treatment area B to A (full integration)	Unify sludge treatment function only (partial integration)
Costs (25years)	Total cost	5,879 million (JPY)	4,368 million (JPY)	5,016 million (JPY)
	Cost per year	235 million (JPY)	175 million (JPY)	201 million (JPY)
Technological		-	the capacity of the pipe etc	the capacity of the treatment plant etc
Environmental (25years)	Energy consumption	120 million(MJ)	109 million(MJ)	116 million(MJ)
	GHG emissions	16,732 (t-CO2)	15,116 (t-CO2)	16,144 (t-CO2)
Evaluation results		△	◎	○

4. Utilization of study findings

The findings are to be published as technical data (Technical Note of NILIM). We hope that local governments use the findings of this study to promote efficiency increase in sewage treatment systems.

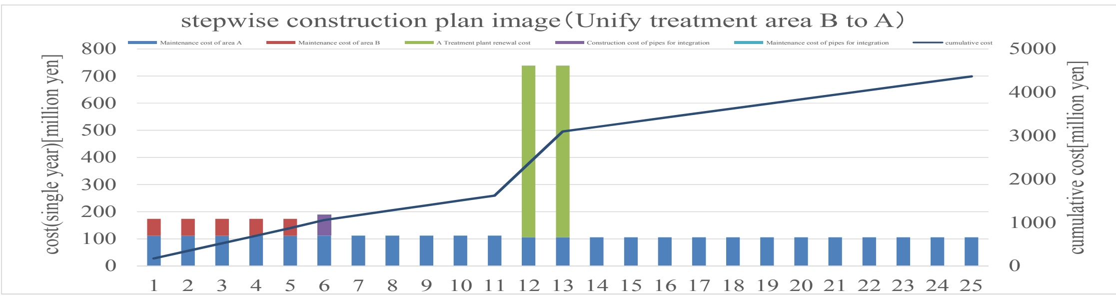


Figure 3: Example of stepwise construction plan (in virtual city)