Value Enhancement and Energy / Labor / Cost Saving for Sewerage Systems

TAKASHIMA Eijiro, Director of the Water Quality Control Department

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1. Roles of National Institute for Land and Infrastructure Management (NILIM) in Sewerage Field

Sewerage system plays a significant role in the living environment, water environment, water cycle, and resource cycle in national land. Meanwhile the entities providing sewerage service are local governments ranging from big cities to small municipalities, with various financial and technical capabilities.

Water Quality Control Department of NILIM is responsible for solution of issues and improvement of technical level concerning sewerage systems from the viewpoint of national land. Major roles of the Department include the collection and analysis of information concerning the past performance of development and maintenance and needs of local entities and the development / introduction / evaluation of technologies leading to cost reduction, efficiency enhancement, or value improvement. It is also required to issue such information in an easy-to-understand manner.

2. Status and issues of sewerage systems

Sewerage systems in Japan have been developed rapidly since the period of high economic growth, and the percentage of population connected to public sewerage amounted to 77%, the total extension of sewage pipes reached about 460,000 km, equivalent to 11.5 times round the earth, and the total number of treatment facilities came to about 2,200. In the future, aging of the large number of these facilities will proceed rapidly. Also, the percentage of population connected to wastewater treatment facilities including household wastewater treatment tanks amount to as much as 89%. Accordingly, it may be required in the future to reorganize the facilities in developed areas for further cost reduction etc. as well as to develop undeveloped areas.

As for measures to prevent inundation of rain water, inundation damage has often occurred in recent years even in the developed areas due to the increase in local heavy rain. Therefore, technologies are required for mitigating inundation damage, including improvement of facilities and operation methods by analyzing detailed information of rainfall and performance of facility operation.

The management and system of most sewerage projects are faced with severe conditions. Further, the amount of waste water flowing into sewerage is forecasted to reduce substantially across the country in the future due mainly to decrease in population and increase in water saving trend. This is a major negative factor for sewerage service income. Also, streamlining of the personnel has been proceeding in local governments and other organizations.

In order to support the lives of people and maintain the sound water environment, it goes without saying that continuation of sewerage system is required. Therefore, re-inspection or correction of plans and facilities, addition of new value, stock management, risk management, etc. are required.

Emissions of greenhouse gas from sewerage are 6,620,000 t in CO_2 conversion, accounting for 0.6% of the total emissions in Japan. Of this figure, emissions from electricity consumption account for 60% and N_2O, 30%. Accordingly, development and dissemination of energy saving techniques are required, as well as an approach to ensure compatibility between water quality conservation and reduction of energy consumption in treatment facilities for the whole basin. Also, method for controlling N_2O generation is required.

In addition to energy saving, energy creation, i.e. utilization of biomass energy, collection of resources such as nitrogen and phosphorus are also important, but the sewage biomass recycling rate remains 24% (Figure 1).

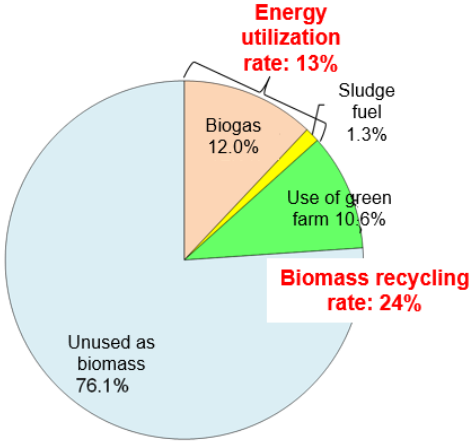

Figure 1. Use of Organic Matter in Sewage Sludge (Fiscal 2012)

3. What is required for sewerage technologies

Various conditions are required for sewerage technologies but are here discussed on the following two points.

(1) Energy, labor, and cost saving

The stock of facilities is now large and many facilities are becoming deteriorated. Since alteration of existing facilities is becoming the main stream rather than construction of new facilities, it is required to introduce facilities that save energy, labor, and cost, as stated in 2 above. Development of technologies to that end is the most important.

Also, in the Breakthrough by Dynamic Approach in Sewage High Technology Project ("B-DASH Project") [1)], field operational tests have been conducted since fiscal 2014 for multiple water treatment technologies emphasizing energy saving. In the first place, B-DASH Project aims at substantial reduction of life cycle cost and energy saving or energy creation, and using its system, it is necessary to introduce the technical development that innovatively advances "energy, labors and cost saving."

In order to grasp efficiently the condition of deterioration in facilities, the investigative technique for facilities is also essential. Sewerage pipelines are laid underground and most of their sections are located in inaccessible areas. For this reason, deterioration diagnoses have been conventionally conducted for each manhole section by step-by-step monitoring operation in the TV camera car (Figure 2). For this operation, it is also required to develop equipment that allows continuous diagnosis in a long distance by successfully responding to level differences and other obstacles in the pipeline and introduce robots and automation to ensure substantial labor and cost saving.

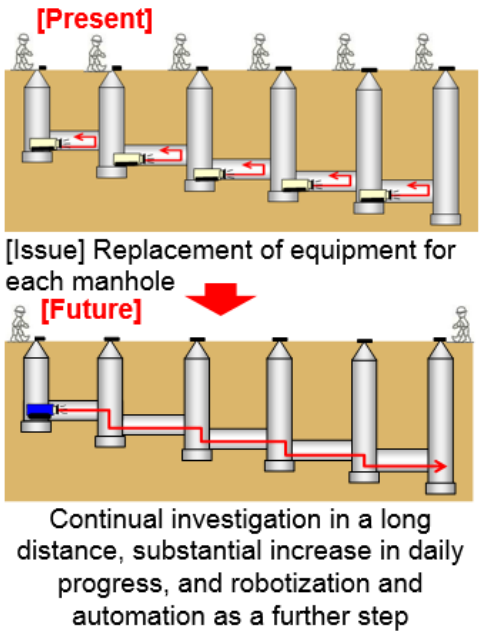

Figure 2. TV Camera Investigation in Sewerage Pipeline

Basic research on stock management of sewerage pipelines as infrastructure of land would be one of the significant missions unique to NILIM.

(2) Value improvement for sewerage system

As stated, the sewage biomass recycling rate is low, but it is expected to maximize the utilization of the energy and resources contained in sewage. For that purpose, major issues are further development of technologies and dissemination and promotion of developed technologies through cost reduction etc. In addition, for small to medium local governments with limited personnel, it is significant to develop conditions what easier to undertake. It is also significant to lower cost and facilitate introduction by advancing unitization of energy creation facilities and packaging of the whole including relevant parts. For this, utilization of B-DASH Project is expected.

Furthermore, in order to enhance the value of sewage treatment facilities, there is also a method of processing local biomasses other than sewage (kitchen garbage, human waste, cut grass, etc.) together with sewage. With these approaches, it is expected to expand the scope of contribution of sewerage system and increase income and energy creation, and methods for achieving them should be further developed.

4. Management of sewerage technologies

At present, Water Quality Control Department of NILIM, as executive office is preparing the "Vision for Sewerage Technology," which serves as mid- to long-term technical development plan for the sewerage in Japan. This mainly provides "Road map for each technical development field", and "Technical development promotion measures." After formulation of the Vision, it is scheduled to set up opportunities for continual discussion and adjustment of the direction and contents of the country's sewerage technologies to grasp needs and seeds, ensure matching of them, follow up the plans, and discuss new themes of technical development. Through these approaches, we want to contribute to the development of sewerage technologies in Japan.

[Reference]

1) Home page of B-DASH Project, Water Quality Control Department, NILIM
http://www.nilim.go.jp/lab/ecg/bdash/bdash.htm