Empirical Study and Guideline Formulation on the B-DASH Project concerning Energy Saving / Creation Technologies in Sewage Treatment / Sludge Treatment

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1. Introduction

Sewerage is essential social capital and, as a response to climate change and tightening supplies of resources / energy, it is imperative that mankind tap the potential of all available resources including the use of sewage sludge for energy, in addition to implementing measures to conserve energy.
To respond to such social demand, new technologies are being developed, but they are less used in practice and many sewerage service providers are cautious about introducing them. For this reason, MLIT launched the "Breakthrough by Dynamic Approach in Sewage High Technology" (B-DASH Project) in fiscal 2011, and the Water Quality Control Department at NILIM has been serving as the steering agency of this test project. The purpose of this project is to demonstrate excellent and innovative technologies, formulate guidelines for introducing them, and disseminate them in order to reduce costs of sewerage service, create renewable energy and pursue other noble causes. Of the guidelines for technology introduction newly formulated in this fiscal year, this paper reports three guidelines concerning energy saving / creation and one for which a new test project started this fiscal year.

2. Outline of the guidelines

Guidelines were formulated for each technology based on the results of empirical studies and opinions of local governments, and evaluated by experts. The structure of the proposed guidelines is as follows. (**Table 1**)

Table 1. Structure of proposed guidelines

Chapter 1. General Provisions	Objective, scope of application, definitions of terms
Chapter 2 Outline of the Technology	Characteristics of the technology, terms of application, evaluation results
Chapter 3 Consideration of Introduction	Method for considering introduction, examples for considering the effect of introduction
Chapter 4 Planning and Design	Introduction planning, design
Chapter 5. Management	Inspection items, frequency, etc.
Data	Demonstration results, case studies, etc.

3. Outline of demonstrated technology, etc.

The following sections (1) to (3) give an overview of the newly formulated guidelines, while section (4) introduces the test project that newly started.

(1) Technology for utilization of local supply energy for local consumption by high-efficiency digestion system
A test project was conducted in order to verify stable operation of the digester, the increase in gas generation and other technical matters concerning a high-efficiency digestion system that combined the utilization of unused biomass generated from small-scale treatment facilities, etc., a non-powered digester stirring device, a sludge solubilization device that increases biogas generation, and an efficient fuel cell using biogas. This technology is expected to improve the energy self-sufficiency ratio of sewage treatment facilities and reduce the treatment cost by concentrated treatment of sludge. (**Fig. 1**)

(2) Power generation type sludge combustion technology for greenhouse gas reduction
We conducted demonstrations in order to verify power generation and the NOx / N_2O emissions reduction effect of the foregoing system in combination with the high-efficiency power generation technology that utilizes unused waste heat from the sludge incinerator, and local stirring air blowing technology that simultaneously reduces NOx / N_2O emissions and is applicable to existing fluidized bed type sludge incinerators. Introduction of this technology is expected to improve power self-sufficiency rate and

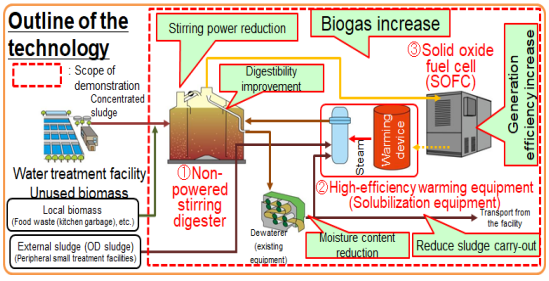

Fig. 1. Outline of the technology

greatly reduce greenhouse gas emissions in sewage facilities. (**Fig. 2**)

(3) Technology for practical collection and use of methane by way of a refiner and occlusion container
In order to conduct stable gas purification and power generation throughout the year, we conducted demonstrations of power generation technology fueled by surplus biogas that is generated, purified, and stored into occlusion containers at multiple small- to medium-sized sewage treatment facilities, and then transported by vehicles for concentration in one location. Introduction of this technology is expected to promote the effective use of sewage-derived energy in small- to medium-sized sewage treatment facilities, a reduction in maintenance cost by energy creation, and other benefits (**Fig. 3**).

(4) Advanced treatment technology by ICT-AI control of single-chamber nitrification and denitrification process
We conducted a test project at the Machida City Naruse Clean Center using treatment technology for achieving water quality equivalent to advanced treatment by controlling air content according to the fluctuation in reaction tank inflow load with ICT / AI, and for reducing power consumption by automatically computing / controlling fan discharge pressure according to air content. Introduction of this technology is expected to decrease construction cost compared with advanced treatment, realize energy-savings, and reduce the maintenance burden of administrators, and thereby promote advanced treatment. (**Fig. 4**)

4. Utilization of findings and future development
NILIM formulated the guidelines based on the results of the test project and gave a presentation at the Pacifico Yokohama Conference Center in August 2019 to introduce the guidelines to local governments, sewerage related companies, etc., which was attended by more than 100 persons. Note that a facility for demonstrating the advanced treatment technology by ICT / AI control of the single-chamber nitrification and denitrification process was completed in January 2020 and started operation.
We intend to continue demonstrating new technologies and disseminate innovative technologies through the introduction of guidelines, etc.

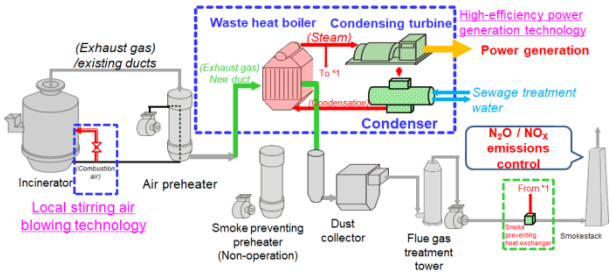

Fig. 2. Outline of the technology

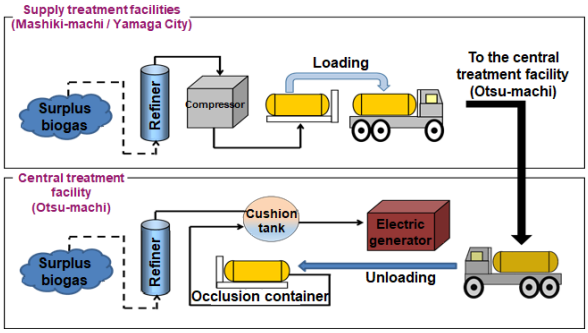

Fig. 3. Outline of the technology

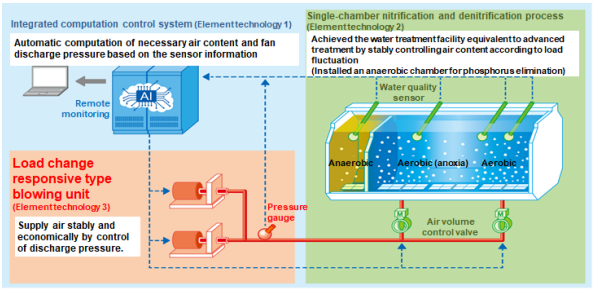

Fig. 4. Outline of the technology

☞**See the following for details.**
[Reference] Guidelines posted:
http://www.nilim.go.jp/lab/ecg/bdash/bdash.htm