Empirical Study on B-DASH Project (Technology for utilization of local production for local consumption type energy by high efficiency digestion system, Global warming countermeasure type sludge combustion technology, Technology for improving sewage treatment capacity at low cost)

(Study period: from FY2017)
Hiromasa YAMASHITA Hiromasa, Head Taichi OTA, Senior Researcher Tsuyako FUJII, Researcher
Akihiro YAMAMOTO, Researcher Manabu MATSUHASHI, Researcher
Kosuke WATANABE Kosuke, Guest Research Engineer
Wastewater and Sludge Management Division, Water Quality Control Department

Keywords: sewerage, energy saving, cost reduction, greenhouse gas reduction, innovative technology

1. Introduction

In order to promote energy saving and energy creation in sewerage, low-cost and efficient innovative technologies need to be developed. Accordingly, the MLIT has been promoting the "Breakthrough by Dynamic Approach in Sewage High Technology" (B-DASH) project since fiscal 2011 in order to realize cost reduction, creation of renewable energy, etc. in sewerage projects through acceleration of R&D and practical use of innovative technologies and to support overseas development of the water business by Japanese enterprises. In addition, National Institute for Land and Infrastructure Management (NILIM) has been studying innovative technologies as a commissioned research in the B-DASH project. We also started to study further six technologies in fiscal 2017.

Of these six technologies newly studied, this paper introduces the outlines of three empirical studies --- "Empirical study on practical use of the technology for utilization of local production for local consumption type energy by high efficiency digestion system," "Empirical study on the generation type sludge combustion technology considering greenhouse gas reduction," and "Empirical study on the technology for improving the treatment capacity of final settling tank."

2. Outline of the empirical study on practical use of the technology for utilization of local production for local consumption type energy by high efficiency digestion system (Joint Research Organization of Mitsubishi Kakoki Kaisha, Ltd., Kyushu University, Japan Sewage Works Agency, and Karatsu City)

In the sewerage service, concentration of resource energy and formation of energy supply center are required, as well as utilization of unused biomass and establishment of a local production for local consumption type energy system.

For this reason, this empirical study demonstrates the effect of improvement in processing performance, energy recovery rate, etc. with regard to utilization of unused biomass such as garbage, non-powered digester stirring device, solubilization equipment that increases biogas generation, and high-efficiency digestion system in combination of fuel cells with high generation efficiency.

Specifically, demonstration facilities are prepared to study the effect of improving the maintenability of non-powered stirring type digester and of reducing running cost, effect of improving digestibility and increasing biogas with high-efficiency heating equipment (solubilization equipment), effect of enhancing the generation efficiency with solid oxide fuel cell (SOFC) not requiring precious metal as an electrode catalyst, etc.

Demonstration and introduction of this technology is expected to lead to LCC reduction due to decrease in sludge emissions and stirring power, increase in biogas by concentration of local biomass and sludge, reduction of sludge disposal cost, improvement of energy self-sufficiency rate, etc.

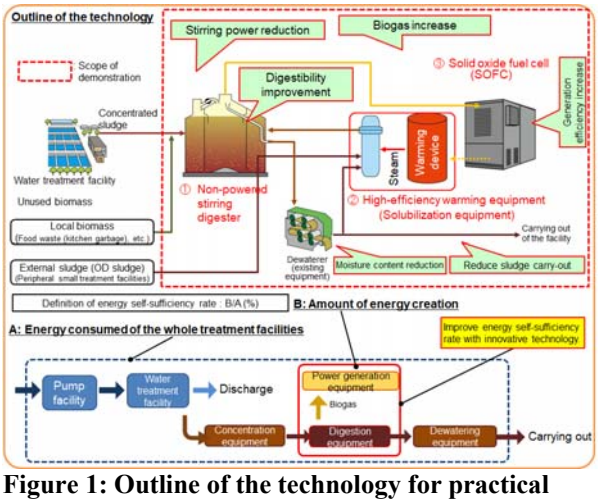

Figure 1: Outline of the technology for practical use of the technology for utilization of local production for local consumption type energy by

high efficiency digestion system

3. Outline of the empirical study on the generation type sludge combustion technology considering greenhouse gas reduction (Joint Research Organization of JFE Engineering Corporation, Japan Sewage Works Agency, and Kawasaki City)

As the Act concerning the Promotion of the Measures to Cope with Global Warming (Global Warming Prevention Act) was enforced, reduction of greenhouse gas emissions is becoming required. For the sewerage service, reduction of CO_2 emissions deriving from power consumption and N_2O (global warming potential is about 300 times) emissions from sludge incinerators is required.

Accordingly, this empirical study aims to demonstrate the effect of improvement in power self-sufficiency rate and substantial reduction of greenhouse gas emissions is produced from combination of the high efficiency power generation technology utilizing unused waste heat from the sludge incinerator and the local stirring air blowing technology applicable to existing sludge incinerators (fluidized bed).

Specifically, demonstration facilities are prepared to study the effect of improvement in generation efficiency by adopting a high-efficiency small condensation type turbine and a condenser that uses sewage treatment water as cooling water, the effect of reducing N_2O emissions with the local stirring air blowing technology enabling space-saving installation and not requiring complicated management of piping, etc.

Demonstration and introduction of this technology is expected to lead to reduction of energy consumption and greenhouse gas emissions, etc.

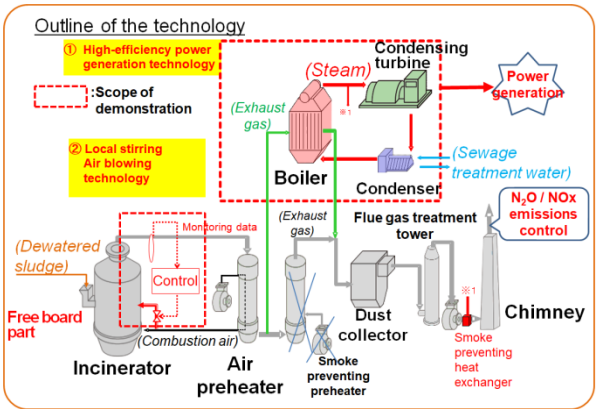

Figure 2: Outline of the generation type sludge combustion technology considering greenhouse gas reduction

4. Outline of the empirical study on the technology for improving the treatment capacity of final settling tank (Joint Research Organization of Metawater Co., Ltd., Japan Sewage Works Agency, and Matsumoto City)

Time to renew sewage treatment facilities is approaching for many local governments, which are faced with the issues of depopulation, financial deterioration, etc. and technology for renewal to sewage treatment facilities that can handle changes in the amount of treatment water at low cost.

This empirical study therefore aims to demonstrate a technology for improving treatment capacity quantitatively or qualitatively at low cost by installing a filtration component and using the existing final settling tank body without adding a final settling tank, and to establish a new sludge management method available for considering applicability of the technology, etc.

Specifically, demonstration facilities are prepared by installing easily maintainable filtration equipment in the existing final settling tank in order to study (i) the effect of improving quantitative performance to double treatment capacity without degrading the quality of treated water, (ii) the effect of improving qualitative performance to realize the quality of treated water similar to that of rapid filtration in the designed volume of treatment water, (iii) derivation of an expression to predict the height of final settling tank sludge interface using a new sludge settlement volume index (SSVI) for examination of applicability of this technology, (iv) applicability to operation management, etc.

Demonstration and introduction of this technology is expected to lead to prevention of water quality deterioration by increase in treatment capacity, improvement in sewage treatment capacity using existing facilities, etc.

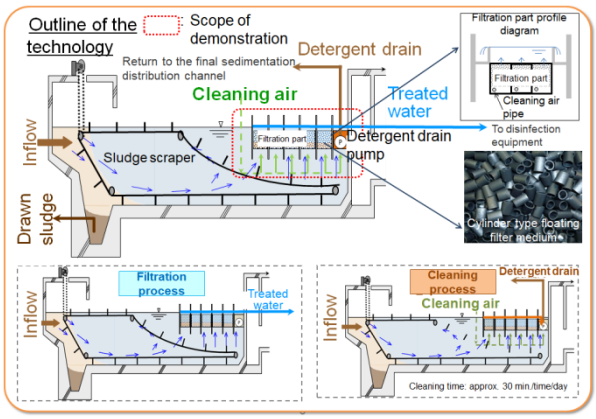

Figure 3: Outline of the technology for improving the processing capacity of final settling tanks

5. Future development

NILIM is going to continue to lead the empirical studies and formulate guidelines for considering introduction of technologies based on study results, and promote dissemination and development of the guidelines.

☞See the following for details.

[Reference] Website introducing B-DASH

http://www.nilim.go.jp/lab/ecg/bdash/bdash.htm