Demonstration on Practical Application of Energy Utilization of Local Production for Local Consumption with Highly Efficient Digestion System (B-DASH)

(Research for FY 2017-18)

1. Purpose

This study deals with combination technology that consists of a digester with the self-agitation system, highly efficient heating devices (solubilization devices), and solid oxide fuel cell (SOFC).

The study aims to demonstrate the technology makes highly efficient anaerobic digestion, recover and reuse energy, and reduce sludge generation. The goal of the project is:

- To reduce the disposal cost of local biomass by accepting it along with outside sludge
- To encourage municipal WWTPs to integrate local energy and resources, be independent, and function as a supply base regional hub

This research is adopted as B-DASH project[*1] 2017 of MLIT[*2]. The consortium of Mitsubishi Kakoki Kaisha, Ltd; Kyushu University; Japan Sewage Works Agency (JS) and Karatsu City conducts the demonstration as an entrusted research project of NILIM[*3].

*1.B-DASH Project: Breakthrough by Dynamic Approach in Sewage High Technology Project
*2.MLIT: Ministry of Land, Infrastructure, Transportation, and Tourism
*3.NILIM: National Institute for Land and Infrastructure Management

2. Summary of the demonstration technology

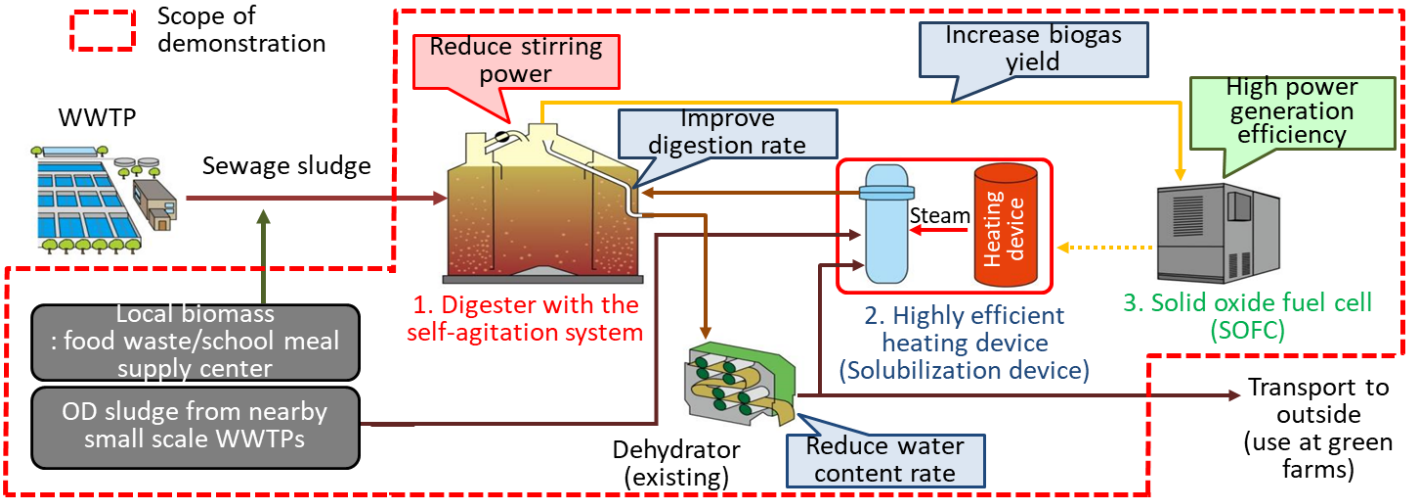

Figure1: Flow diagram of demonstration system

The demonstration technology consists of:

- Digester with the self-agitation system that makes methane fermentation with no external motivity
- Highly efficient heating (solubilization) device that reduces sludge volume and heats the digester while increasing biogas yield by sludge solubilization
- SOFC that generates electricity using biogas

The demonstration includes a facility accepting dewatered sludge (OD sludge) generated at nearby WWTPs adopting Oxidation Ditch process and a facility accepting food waste. The integrated treatment of local biomass is expected to reduce its disposal costs and increase biogas yield.

3. Achievements of this year

In the demonstration facilities set up at Karatsu City WWTP (Saga Prefecture), the digester with the self-agitation system started running, a highly efficient heating (solubilization) device started continuous operation and SOFC was tested its performance.

(1) The digester made a self-agitation operation using biogas generated inside. It was verified that the existing mesophilic digestion facilities could reduce their agitation power by 98% by using a self-agitation digester.
(2) The demonstration facilities generated gas of 440Nm^3/t-VS and had a digestion rate of 61.5%. On the other hand, achievement values of the existing mesophilic digestion facilities are 469Nm^3/t-VS and 52.8%, respectively. The target values of gas yield and digestion rate are 540Nm^3/t-VS and 62.8%, respectively. The possible cause that the demonstration facilities did not achieve the target values is that the initial operation of the digester had not completed.
(3) It was verified that the demonstration achieved the power generation efficiency of 51% against targeting value of 50% and over and achieved an overall efficiency of 86%.
(4) LCC estimation using the past research results represented the demonstration technology reduced LCC by 21% compared to the conventional mesophilic digestion plus power generation.

4. Future issues

The demonstration continues next year to verify the digestion performance of the digestion system using a digester with the self-agitation system and highly efficient heating (solubilization) devices, study the digestion efficiency by the acceptance of local biomass, and evaluate the performance and stability of SOFC.

Keywords: Anaerobic digestion, Solubilization, Digestion gas power generation, Local biomass