

# Establishment of Total Optimization Procedure for WWTP

(Research of FY 2018-2021)

## 1. Purpose

This study aims to establish the total optimization procedure for WWTP, which defines achievable levels for minimizing energy consumption and greenhouse gas emissions, and maximizing resource utilization of the whole WWTP. The working items are as follows;

- ① The primary balance of WWTP: Organize wastewater/sludge treatment flows by the treatment method/scale. Create balance sheets of materials, energy, and CO2 emission for each flow.
- ② Systematization of JS' elemental technologies: Systematize elemental technologies that JS owns.
- ③ Establishment of WWTP optimization procedure: Establish the selection manner of elemental technologies for WWTP optimization and presentation manner of the balance of the optimized WWTPs.
- ④ Development of the WWTP optimization tool: Develop the optimization tool that enables the presentation of achieving levels against the needs, including energy-saving, energy generation, and cost reduction by the optimization method established at ③.

## 2. Outcomes of This Year

This year, the primary balance of WWTP(①), Systematized JS' elemental technologies(②), and established optimization procedure for WWTP (③) were created.

- (1) Study on the primary balance of WWTP

Table 1 describes wastewater treatment plans. The table allocates the sludge treatment process to the wastewater treatment process based on the wastewater statistics, etc. The plan picked up 14 processes as major sludge treatment processes to study each primary balance.

Table 1. Treatment process setting patterns

| Maximum daily treatment capacity |                                     | Wastewater treatment process | Sludge treatment process   | Number of flows |
|----------------------------------|-------------------------------------|------------------------------|--|-----------------|
| Small-scale                      | 10,000m <sup>3</sup> /day or less   | OD process                   | Thickening, Thickening-dewatering, Dewatering                                      | 3               |
|                                  |                                     | CAS process                  | Thickening-dewatering, Thickening-digestion-dewatering                             | 2               |
| Medium-scale                     | 10,000-100,000m <sup>3</sup> /day   | CAS process                  | Thickening-dewatering-incineration, Thickening-digestion-dewatering-drying(yes/no) | 4               |
|                                  |                                     | Nutrients removal            | Thickening-dewatering-incineration, Thickening-digestion-dewatering-drying(yes/no) | 3               |
| Large-scale                      | 100,000m <sup>3</sup> /day and over | CAS process                  | Thickening-dewatering-incineration, Thickening-digestion-dewatering                | 2               |
| Total                            |                                     |                              |  | 14              |

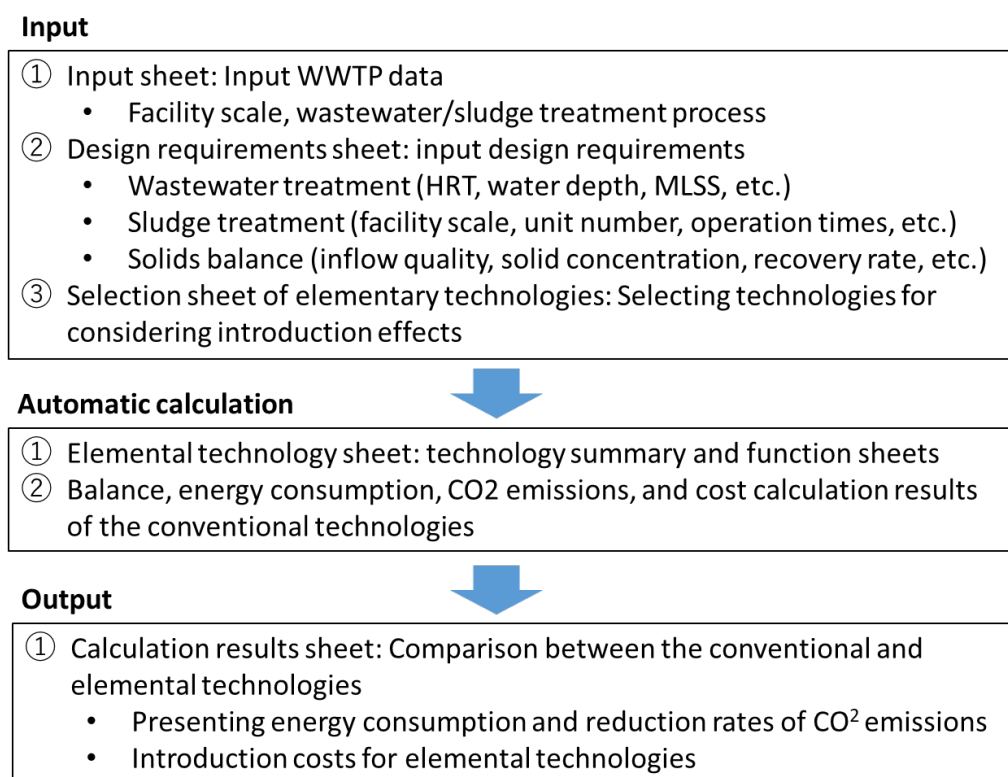
## (2) Organization of the elemental technologies

Cost functions were created to study their technical summaries, requirements, and adoption effects to classify elemental technologies of nine kinds of wastewater treatment, six thickening/digestion, fifteen dewatering, nine incineration, and two others.

## (3) Study on the draft procedure for optimizing the entire wastewater treatment facilities

Table 2 describes the flow of the optimization procedure. A draft of the various input/calculation tool and calculation results were studied to investigate the introduction effects of the elemental technologies.

Table 2. Flowchart of the optimization procedure



(4) Organization of issues

Drafting the optimization procedure found the input of design requirements was complicated. Accessibility improvement became to be an issue.

### 3. Future Schedule

The total optimization procedure will be established by the accessibility improvement, an issue of this year, and additionally organizing required cost functions of greenhouse gas emission and its costs. The established procedure will encourage the development of the optimization tool which can show and compare the adoption effects of the elemental technologies, including the whole wastewater/sludge treatment.

Keywords: Total Optimization for WWTP, Energy independence