A research of energy-saving countermeasures of existing sewerage system		
Whole term	1998.4 ~ 2000.3	

(Purpose)

The electricity used in wastewater treatment plants occupies 0.6% to 0.7% of the total electricity consumption in Japan. Fossil fuels, such as heavy oil, are used in sludge incineration facilities, etc. In addition, methane and dinitrogen monoxide are emitted from wastewater treatment process. Thus, it is necessary for sewerage system to minimize the green house gas emission in the operation as much as possible by applying new technologies and introducing resource-saving countermeasures and energy-saving countermeasures in the future.

Against such a background, the way in which the electricity and energy were used in wastewater treatment plants was investigated and analyzed with the aim to propose energy-saving countermeasures in sewerage system in Japan. Moreover, the possible countermeasures of energy-saving were investigated by compiling existing literatures (e.g. papers presented in the annual meetings of Japan Sewage Works Association).

(Results)

1 Surveyed items

*Brief overview of wastewater treatment plants in Japan (changes in number of wastewater treatment plants of each categorized treatment process), number of advanced treatment plants, and number of assets in each plant, etc)

*Energy consumption of sewage treatment plants

*Consideration of efficient energy consumption in sewage treatment plants

*Energy recovery in sewage system

2 Brief overview of wastewater treatment plants

Categorized by treatment process, the major process are conventional activated sludge process (55.8%) and oxidation ditch process (24.5%). Categorized by capacity, the number of treatment plants with less than 5,000m^3/day of capacity occupies 33.3%, while the number of those with 10,000 to 50,000m^3/day of capacity occupies 29.9%. Small to medium sized treatment plants are increasing in number recently. As for methods for sludge treatment, concentration-dewatering process occupies 38%, while concentration-digestion-dewatering process occupies 14% in number.

3 Energy consumption

Wastewater treatment plants consume annually more than 5 billion kWh of electricity, which is equivalent to 0.6% to 0.7% of the total domestic electricity consumption. The order (descending) of operations in terms of amount of electricity consumption is wastewater treatment, sludge treatment and pumping inside the plants. The equivalent amount of CO_2 emission from electricity and liquid fuels is about 3 million ton annually in 1996, the 70% of which is from electricity consumption.

The electricity consumption per unit of treated wastewater tends to decrease with the increase in the capacity of plants. While average consumption of about 0.5kWh/m^3 is necessary in treatment plants with less than 5,000m^3/day of capacity, only about 0.1kWh/m^3 is necessary in plants with more than 50,000m^3/day of capacity.

In sludge treatment process, the order of processes in terms of amount of electricity consumption is melting, incineration, mechanical drying, dewatering and sludge drying bed. With the reduction of the sludge volume and weight, the energy consumption becomes greater.

The electricity consumption per unit of treated water depends not only on the capacity of treatment plant but also on the operating efficiency of facilities and the treatment process.
Therefore, the electricity consumption rate cannot always be used to evaluate the performance of the treatment plants.

4 Energy-saving countermeasures

The countermeasures and the effectiveness of efficient energy consumption and energy recovery in wastewater treatment plants are compiled from literatures such as papers presented in the annual meetings of Japan Sewage Works Association in the past ten years. With constraints on installation and replacement of facilities, each existing treatment plant especially needs to select feasible countermeasures to apply.

5 Future challenges

There are many options for energy-saving in construction and operation of facilities. A quantitative approach and case studies are needed in the future.

Independent research

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Keywords	Existing facilities, energy-saving