Utilization of Biogas Energy:
Energy Recovery Anaerobic Digestion System

Background

Recently in Japan, global warming or energy issues caused by a frequent natural disaster such as Tohoku earthquake is a matter of concern. Anaerobic digestion process refocuses peoples' attention on its features that the process can recycle energy as biogas or digestion gas.

Japan Sewage Works Agency (JS) has developed digester gas utilization technology focusing on power generation. Besides, JS attempts to establish "Energy Recovery Anaerobic Digestion System" for efficient recovery of digester gas.

In April 2012, JS Technical Committee submitted a report, " Technology Evaluation on Anaerobic Digestion Process for Energy Recovery" to JS president. This report defines features of the technology and its energy recovery benefits. It also deals with important points for design and O&M when applying to WWTPs.

The Energy Recovery Anaerobic Digestion System improves an energy recovery efficiency in WWTPs and enables establishment of the energy self-sufficient wastewater treatment system.

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Carrier-filled High-speed Methane Fermentation

Joint researcher : Metawater Co., Ltd

High efficiency anaerobic digester with thermal hydrolysis unit

Joint researcher : Mitsubishi Kakoki Kaisha, Ltd

Rotary Engine Gas Generation System

Joint researcher : Metawater Co., Ltd , Hiroshima Metal & Machinery Co., Ltd.

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Features of Carrier-filled High-Speed Methane Fermentation

① High-speed fermentation

A digester filled with nonwoven fabric sheet improves a fixing of bacterial cells and increase their concentration. A high-speed, high-temperature digestion reduces a digestion period to 5-10days. These features enable equal or higher digestion efficiency and digestion gas production compared with the conventional methods.

② Small footprint

- Shorter digestion period reduces the size of a digester by one third to one sixth.
- A steel plate digester reduces site area and construction cost.

③Mixing with food waste

The system enables a mixing digestion with food waste that has a high production rate of digestion gas. When working with digestion gas power generation, the system can supply 100% of power consumption at WWTP.

④Stable fermentation

A patent technology that automatically controls the input of raw materials and dilution water, eliminates ammonia inhibition. It enables stable fermentation and reduces human load.

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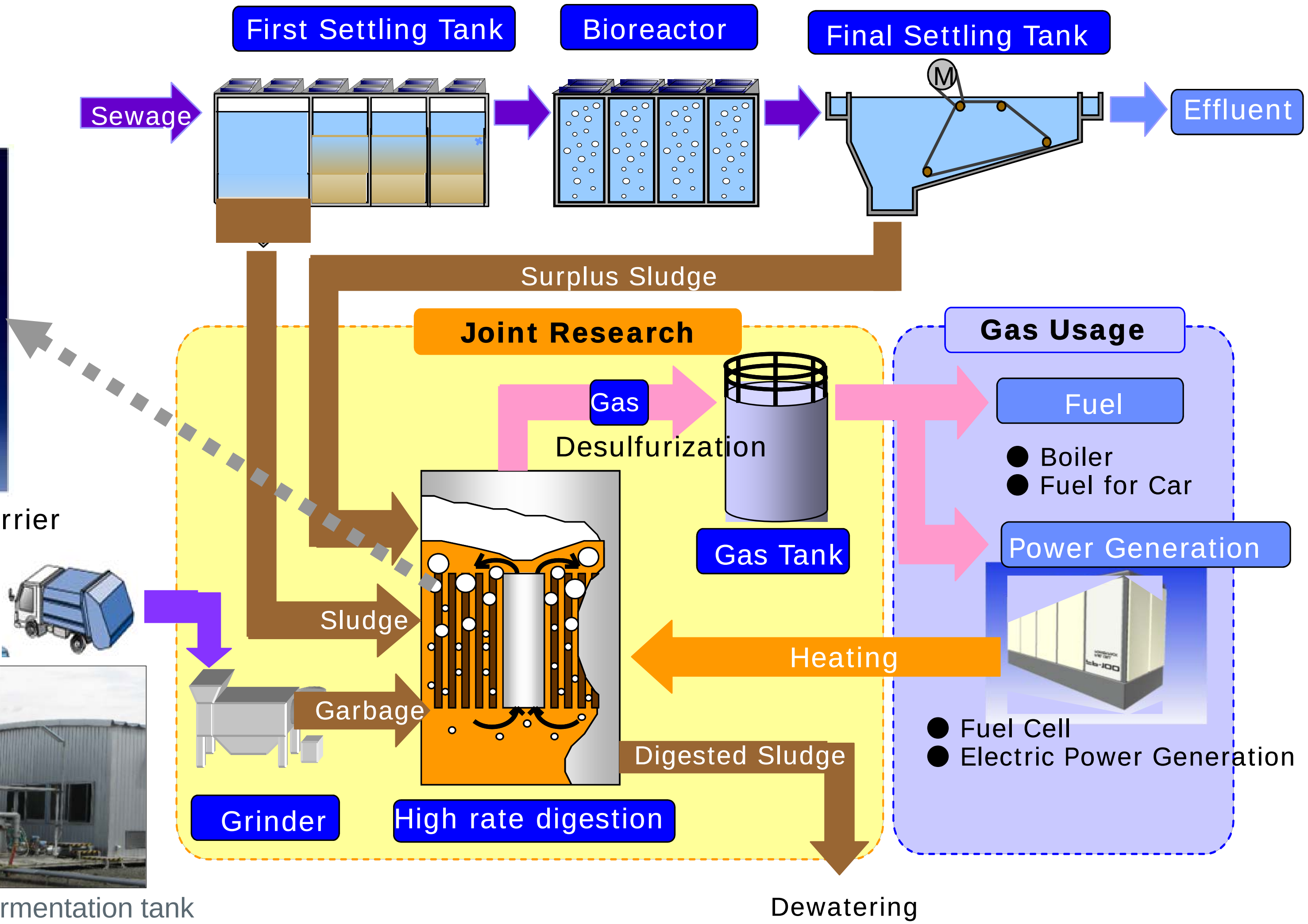
Flow diagram of Carrier-filled High-Speed Methane Fermentation

Non-woven fabric carrier

High rate methane fermentation tank



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Features of High Efficiency Anaerobic Digester with Thermal Hydrolysis Unit

①Improve digestion rate

Thermally modify indigestible sludge residue at 160-170˚C. The sludge residue is re-digested in a digester, and this system improves a decomposition rate of organic matter by 10 points.

②Improve dewaterability of sludge

Modified sludge improves dewaterability of digested sludge and reduces water content rate of dewatered sludge by 5-7 points.

③ Reduce amount of sludge

① and ② reduce the amount of dewatered sludge by approx. half to two third.

④Reduce digestion period

Improved degradability of organic matter in sludge reduces digestion period until 15 days.

⑤Increase recovery of recycle energy

A generation of digestion gas as recycle energy increases by 10-30% comparing with the conventional digestion process.

⑥Additionally applicable to existing digestion facilities

Simple configuration of facilities enables additional installation to existing digestion facilities.

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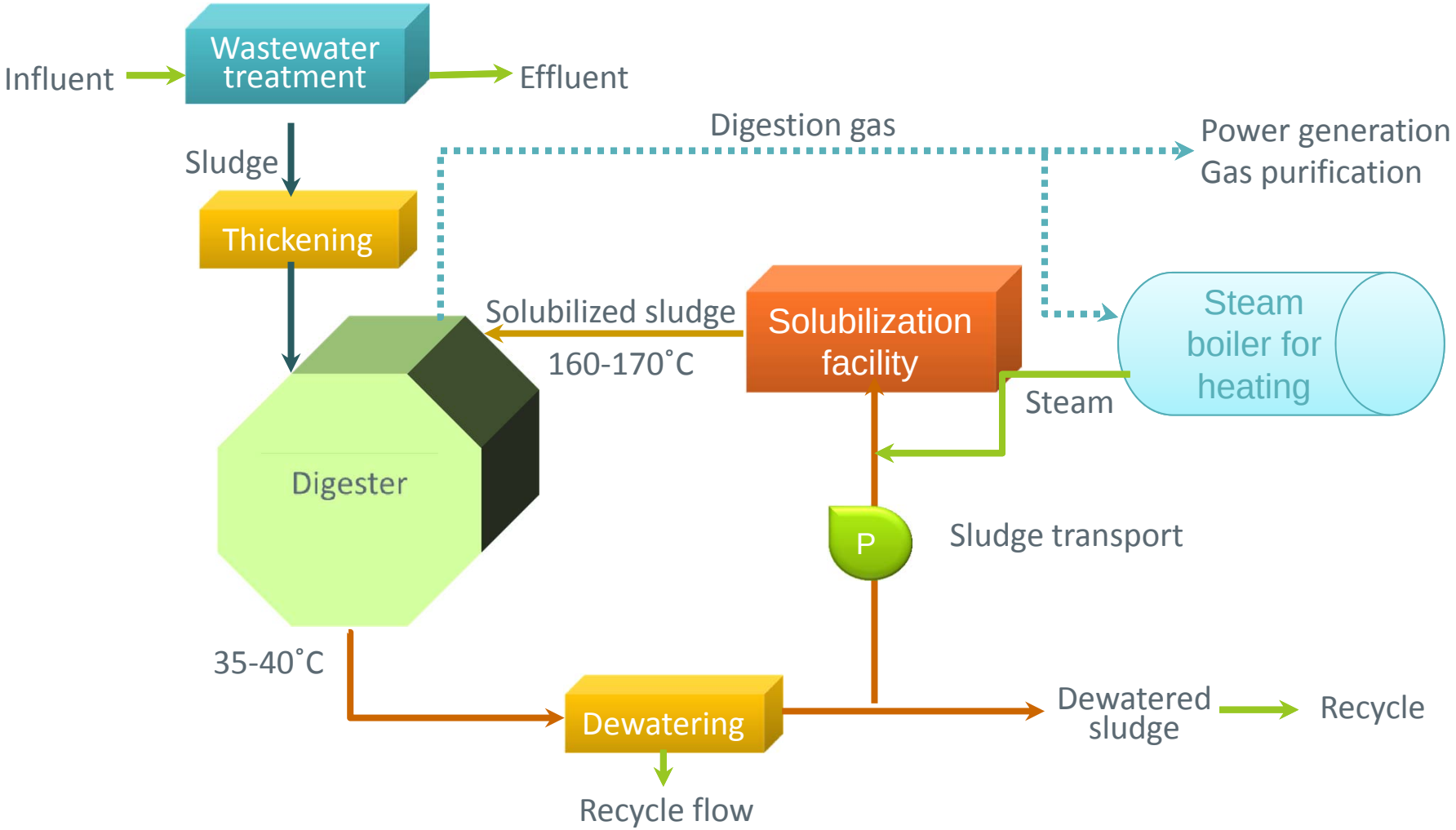
Flow diagram of High Efficiency Anaerobic Digester with Thermal Hydrolysis Unit



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Features of Rotary Engine Gas Generation System

① Compact and lightweight

The rotary engine has more extremely compact and lightweight body than the conventional reciprocating engine with an equivalent power.

② Rotary motion with low vibration

The unitized system requires no foundation work. It can be easily set up at any free space either indoor or outdoor.

③Simple configuration with no bulbs

The system has a simple configuration with no intake/exhaust bulbs that requires low maintenance.

④Domestic engine

The rotary engine is domestically produced having a long successful history as a car engine. It is low-maintenance and has a stable component procurement.