

An Approach for Energy Recovery from Sewage Sludge Using a Steel Plate Digestion Tank

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Introduction

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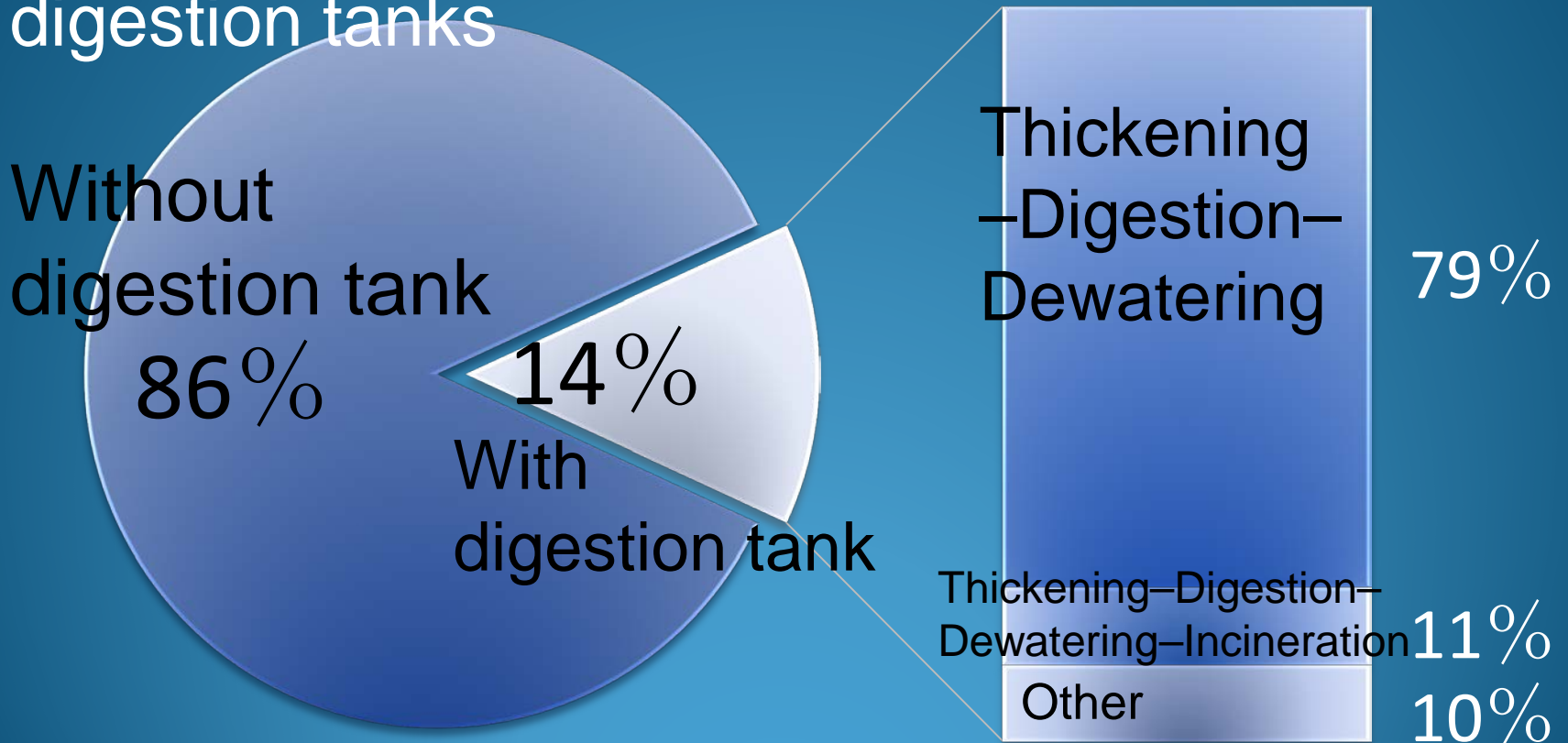
Japan is currently experiencing **severe power shortages** in the aftermath of the Great East Japan Earthquake, and there is an urgent need to promote and expand the **use of renewable energy**.

We need to accelerate the **development / recovery** of energy from sewage sludge.

Japan **relies on imports** for most of its energy
Contribution to measures **against global warming**

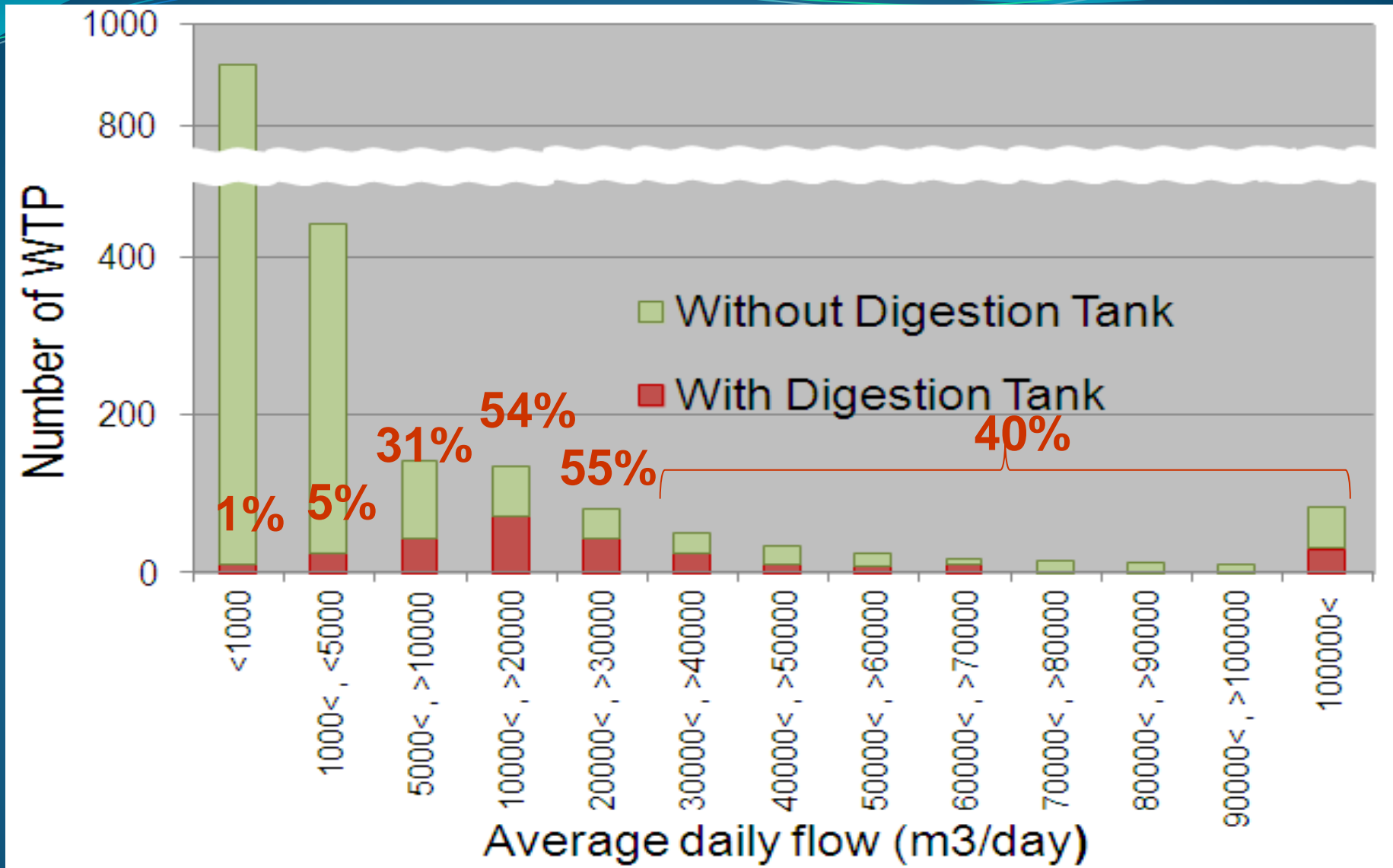
Current situation of anaerobic digestion tanks at sewage plants in Japan

There are approx. 2,200 sewage plants in Japan
Of which, approx. 300 plants have anaerobic digestion tanks



No. of sewage plants 2,200

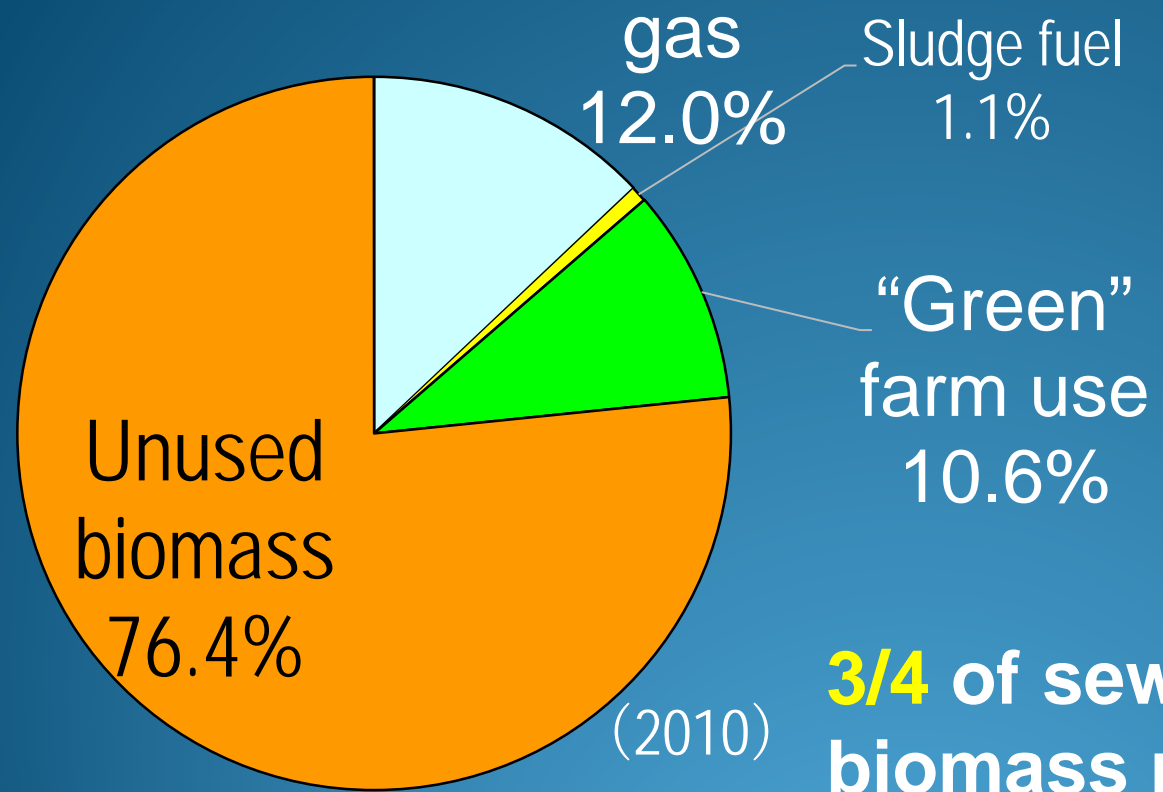
No. of Water Treatment Plants with Digestion Tanks 3/28



Installation of digestion tanks has stalled in small-scale treatment plants

Current biomass utilization at sewage plants in Japan

Digestion

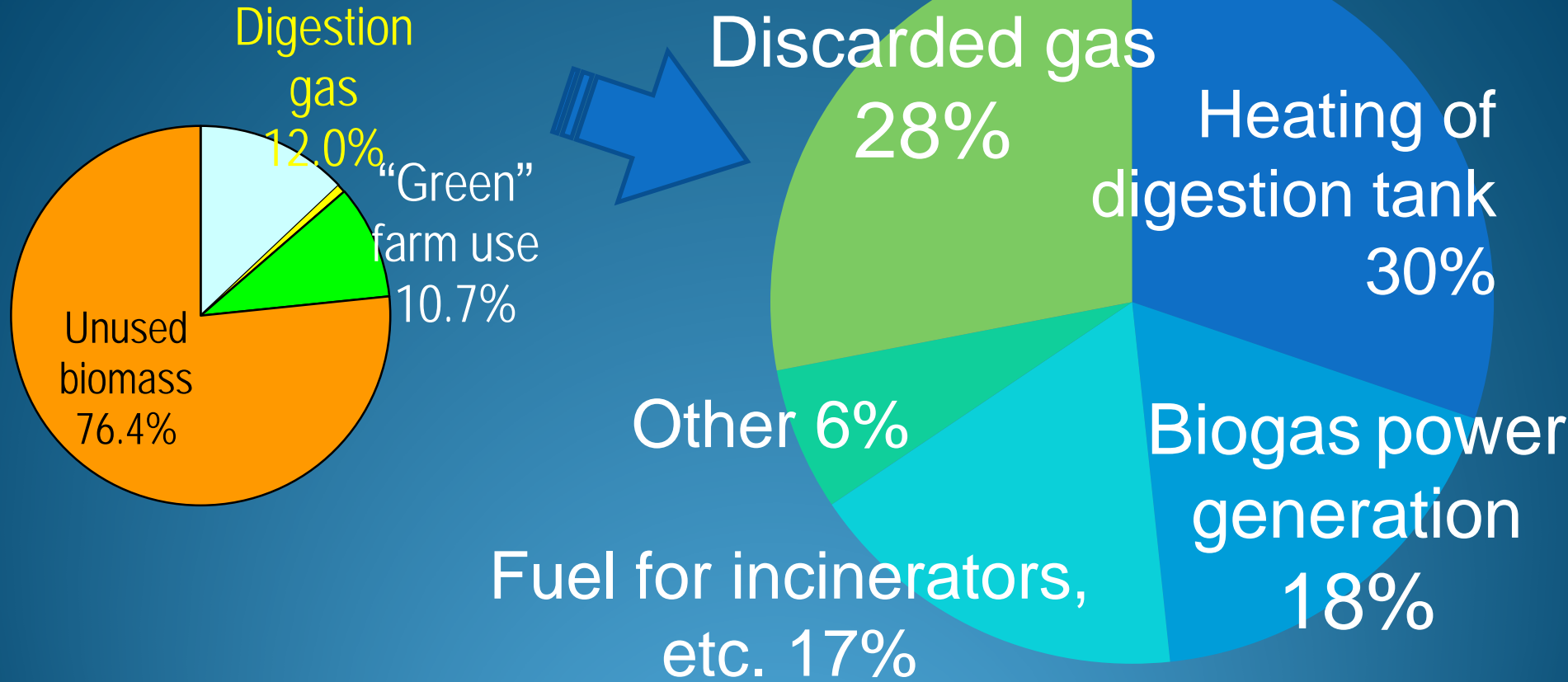


Total amount of biomass
1,810,000 t dry solids/year

3/4 of sewage sludge biomass resources are not being used.

Potential energy from sewage sludge is,
1,810,000 t dry solids/year * 25 MJ/t DS = 45,250 GJ/year

Current biomass utilization at sewage plants in Japan



Digestion gas is being used 70%, but 30% is being disposed of by incineration.

Conventional technology Digestion tank (concrete)



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Problems include **high** initial investment and **long** construction period.



Steel plate digestion tanks make it possible to **reduce** the construction cost and **shorten** the construction period.

This technology shows promise in terms of resolving these problems and promoting future installation of digestion tanks.

Development targets

() Reducing construction cost

Construction cost 1/2 that of concrete tank

Annual cost equal to or lower than that of concrete tank

() Shortening construction period

Construction period 1/2 that of concrete tank

Demonstration study through construction of pilot plant ^{8/28}

Overview of pilot plant construction

Field: Chiba-city Nanbu Wastewater Purification Center

Tank capacity: **750 m³**

Digestion period: **25 days**

Digestion temperature: **37 °C (99 °F)**

Feed sludge: Mechanically thickened **15 t/day** +
Gravity thickened **15 t/day**

TS concentration of feed sludge is **3.4%** on average

Organic matter concentration (VS concentration) is **2.8%** on average

Exterior of pilot plant

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Photograph: Exterior of steel plate digestion tank (capacity: 750 m³)

Demonstration facility construction schedule



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Demonstration facility schedule(70days)



Before

Before
construc
tion



Demonstration facility schedule(70days)



Day 1

Positioning base plate



Demonstration facility schedule(70days)



Day 3

Side
panels
1st
stage



Demonstration facility schedule(70days)



Day 11

Top
6th
stage



Demonstration facility schedule(70days)



Day 16

Fabrica
ting
roof



Demonstration facility schedule(70days)



Day 18

Installing
roof



Demonstration facility schedule(70days)



Day 29

Installing
platforms



Demonstration facility schedule(70days)



Day 41

Installing
auxiliary
equipment



Demonstration facility schedule(70days)



Day 50

Painting
external
surfaces
of tank



Demonstration facility schedule(70days)



Day 55

Installing
Impeller
type
agitator

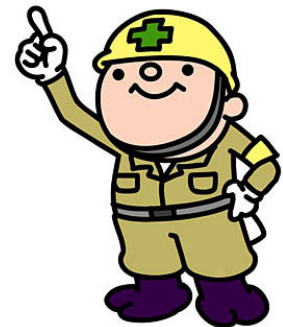


Demonstration facility schedule(70days)



Day 59

Painting
internal
surfaces
of tank

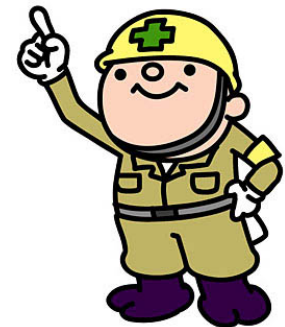


Demonstration facility schedule(70days)

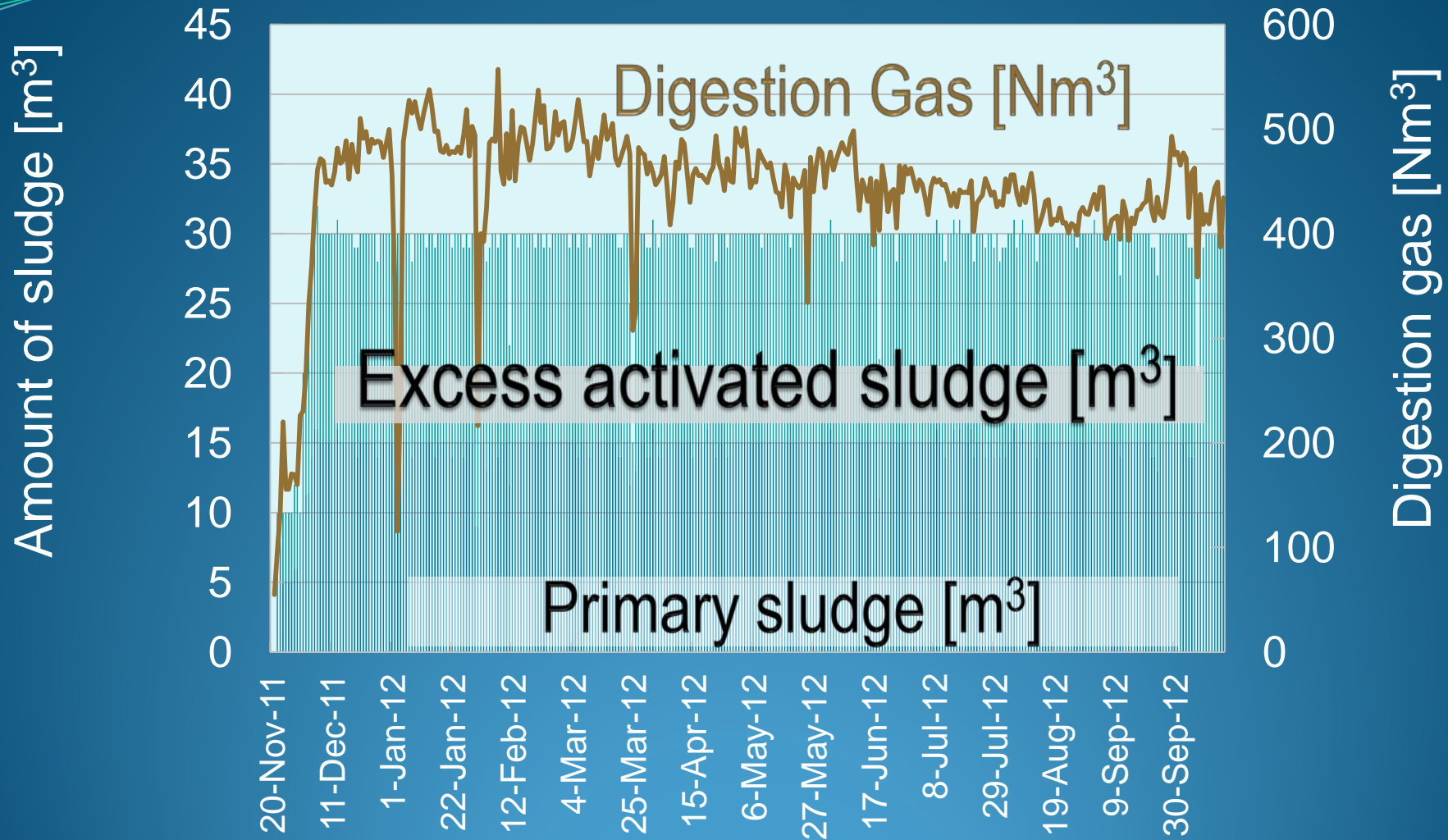


Day 70

**Compl
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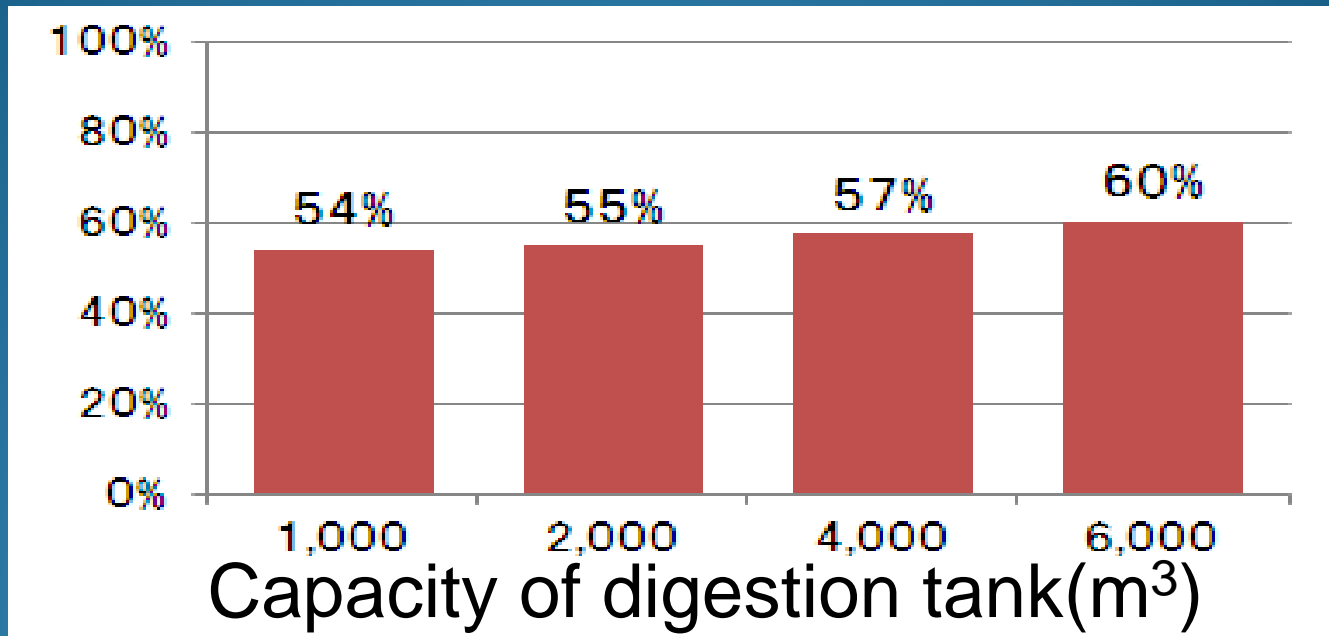
Performing stable treatment.



It was confirmed that the pilot plant was performing stable treatment.

Reducing construction cost

Cost of a Steel plate tank compared to concrete tank(Only Civil engineering facilities)

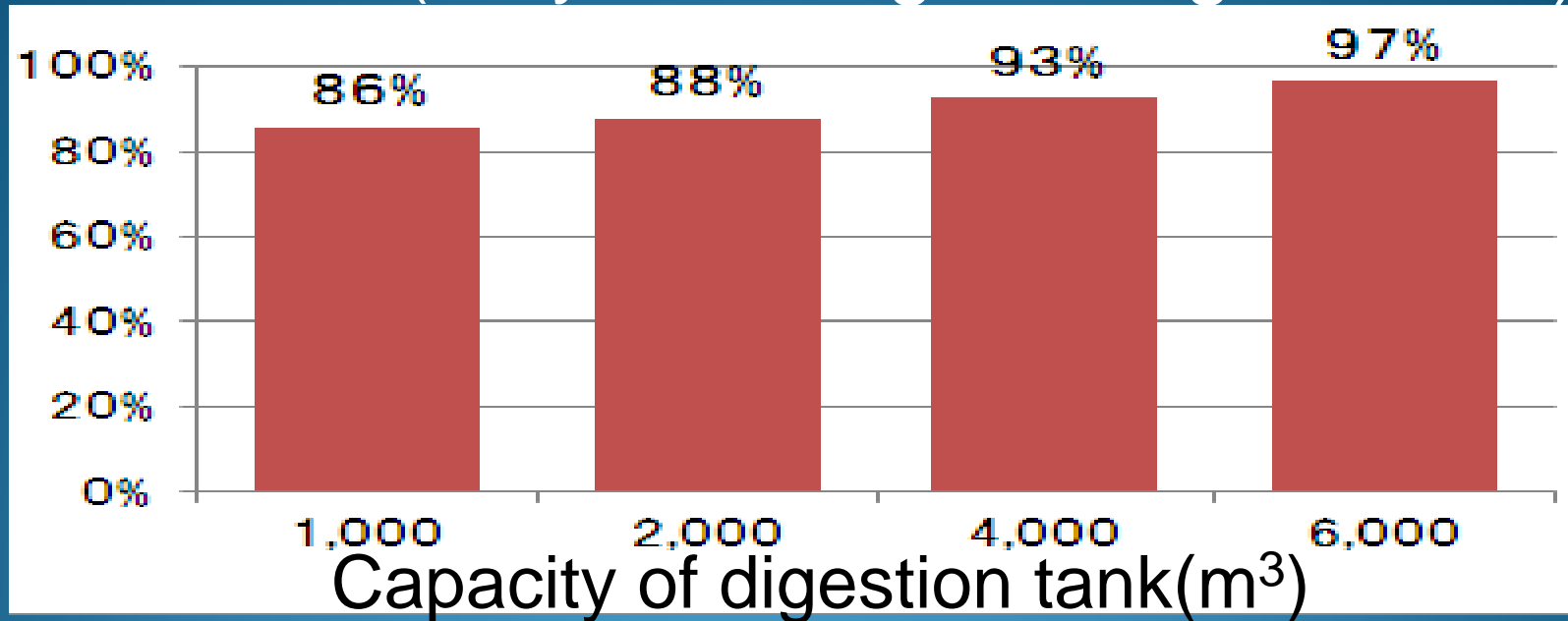


The target was a construction cost of less than 1/2 that of a concrete tank, but it was actually **54%–60%**.

RC tank costs were calculated for 2009, using a cost function from the Basic Planning Manual for Biosolids Utilization (March 2004) and a deflator.

Reducing Annual cost

Annual cost of a Steel plate tank compared to concrete tank (Only Civil engineering facilities)



The annual cost was equal to or lower than that of a concrete tank.

The service life of the concrete tank was taken as **45 years**, the service life of the steel plate tank as **20 years**, and the interest rate as 2.3%.

Shortening the construction period

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The construction period of 2 years for a concrete tank can be shortened to 1 year.

Possible schedule Capacity : 4,000 m³

Installation	Total construction period	Breakdown of required no. of days (days)			
RC digestion tank	561 days 2 years	105	Civil engineering work		
			260 Construction of main body		
			Separate contract	181 Mechanical work	
				191 Electrical work	
Steel plate digestion tank	273 days 1 year	105	Civil engineering work		
			240 Shop fabrication, on-site assembly		
				100 Mechanical work	
				100 Electrical work	

A 750m³ pilot plant was constructed.

30 m³/day * 25 days * 37 °C

The construction period at the pilot plant site was **70 days**.

Adequate digestion performance was obtained compared to the conventional equipment.

As a result of calculating the construction cost, the construction cost was **54–60%**, the annual cost was **86%–97%** that of a concrete tank.

The use of digestion tanks can be expected to grow in the future.

Thank you for your kind attention