

IEA Bioenergy Task 37

# 2015 Korea Country Report

Ho Kang

Berlin (Germany), October 2015



IEA Bioenergy

# Biogas Plant Inventory (2014)

Substrate/Plant type	Number of plants	Production* (GWh/year)
Sewage sludge	45	1,045
Biowaste (co-digestion)	20	427
Agriculture	6	3
Industrial	-	-
Landfills**	<b>21</b>	1,128
<b>Total</b>	<b>92</b>	<b>2,603</b>

\* = produced raw biogas expressed as its energy content from the different plant types

\*\* = based on 2013 data

A total of **92 biogas plants** are now in operation to produce **2,603 GWh per year**. Landfill biogas contributes 43.3% (1,128GWh/yr), biogas from sewage sludge 40.2%, biowaste 16.4%, etc. Biowaste mainly consists of food waste, food waste leachate, and digestible co-substrates.

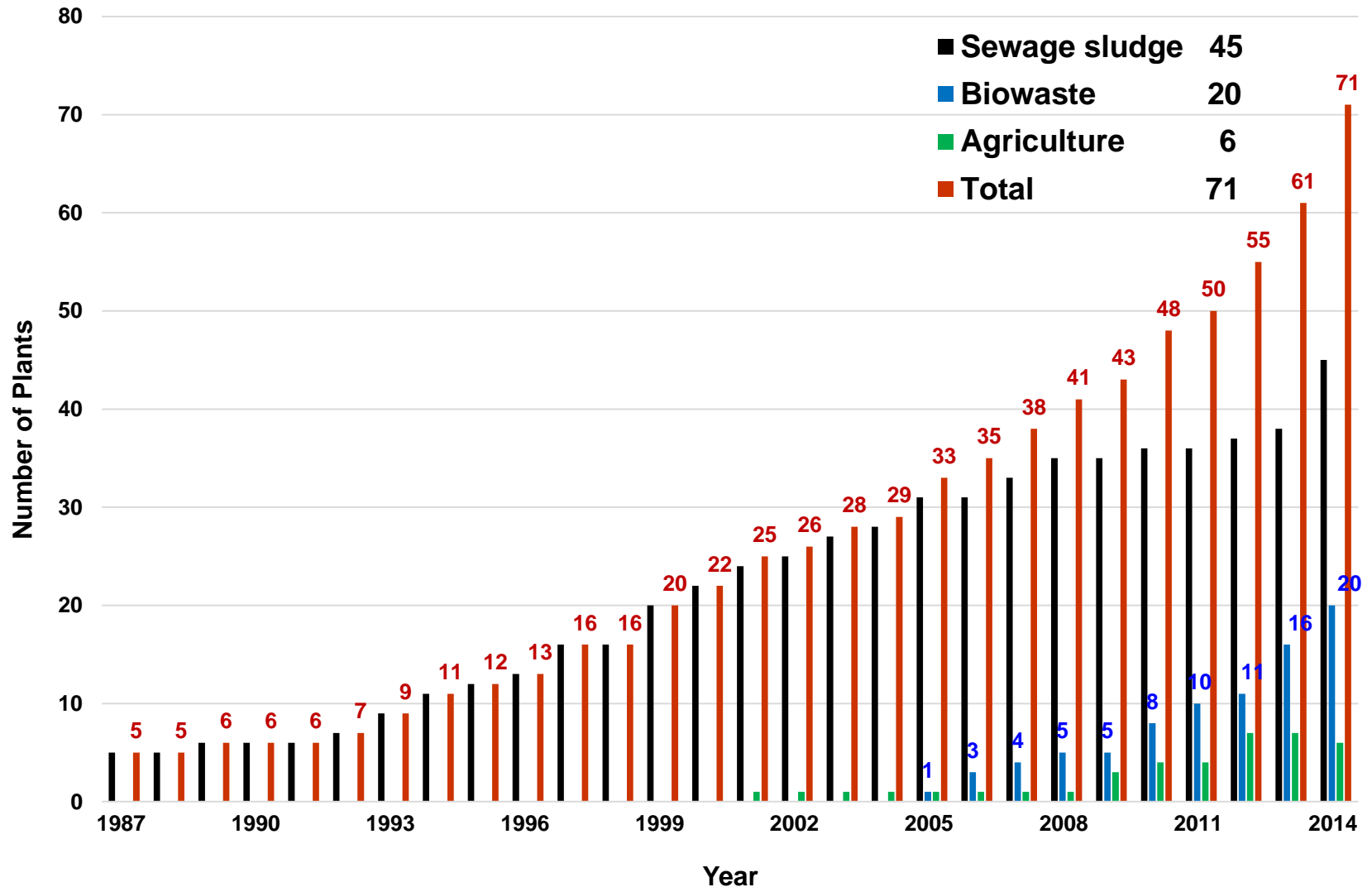
## Biogas Plant Inventory (2014)

- The electricity generation from biogas plants amounted to only 100 GWh in 2014. However the target from bioenergy reactors for the year of 2020 is **847 GWh**.
- There are **15 new biogas plants under construction** to treat 4,764 tons of food waste and food waste leachate daily to produce **454 GWh by 2017**. The electricity generated **from landfill gas (LFG) reached 293 GWh** in 2013.
- The total amount of electricity produced from all biogas sectors including LFG is expected to be **1,937 GWh in 2020**.

# Biogas Upgrading

Name of Plant and Town	Type of Substrates	Year of Operation	Upgrading Technique	Capacity (Nm <sup>3</sup> /hr)	Biomethane Utilization
Seonam (Seoul)	Sewage Sludge	2009.5~	Water Scrubbing	210	Vehicles
Bangcheon (Daegu)	Food Waste	2012.8~	PSA	1,000	Vehicles
Sudokwon Landfill (Incheon)	Food Waste Leachate	2010.12~	PSA	600	Vehicles
Gangneung (Gangwon)	Sewage Sludge	2010.5~	Water Scrubbing	50	Vehicles
Suyoung (Pusan)	Sewage Sludge	2014.9~	Water Scrubbing	600	Vehicles
Changwon (Kyungnam)	Sewage Sludge	2014.7~	Water Scrubbing	600	Vehicles
Wonju (Gangwon)	Food Waste	Under construction	Water Scrubbing	600	Vehicles
Pyungchang (Gangwon)	Food Waste	Under construction	Water Scrubbing	300	Vehicles

# Biogas Plant Trends



# Biogas Plant Trends

Biogas Plant	Sewage Sludge	Biowaste	Agriculture	Total
Under Construction	5	4	7	16
Planned	16	15	12	43

## Biogas Utilization (1)

Utilization	GWh	%
<b>Electricity</b>	<b>1,320</b>	<b>50.7</b>
<b>Heat</b>	<b>664</b>	<b>25.5</b>
<b>Vehicle fuel</b>	<b>26</b>	<b>1.0</b>
<b>Flare</b>	<b>431</b>	<b>16.6</b>
<b>Biogas sale</b>	<b>162</b>	<b>6.2</b>
<b>Total</b>	<b>2,603</b>	<b>100</b>

## Biogas Utilization (2)

- **About 51% (1,320 GWh)** of the biogas is utilized **for electricity production**. **The main part (25.5%, 664GWh)** of the remaining biogas is used **for heat generation**. This part is decreasing every year to meet the increasing demand for biogas sale.
- **Flaring biogas** is still significant (**16.6%**). The utilization of biogas as vehicle fuel was only 1.0% of the total biogas production.
- **Number of buses used CNG as a vehicle fuel reached 31,101** and the number of gas filling stations reached 197 of which 6 are biomethane filling stations. However this figure covers only 0.2% of the total number of buses.



# Digestate Handling

## ● Sewage Sludge AD Digestate

- Dewatered Solids : Landfilling and Incineration
- Dewatered Liquid : Joint Treatment with Domestic Wastewater
- Power plant accepts bio-solid fuel made of dewatered solids containing less than 10% water and greater than 3,000 Kcal/kg

## ● Biowaste AD Digestate

- Dewatered Solids : Landfilling, Incineration, and Raw material for other composting
- Power plant accepts bio-solid fuel made of dewatered solids containing less than 10% water and greater than 3,000 Kcal/kg
- Dewatered Liquid : Used as Raw material for other liquid fertilizer or Joint Treatment with Domestic Wastewater

## ● Agriculture AD Digestate

- Used as liquid fertilizer

# Financial Support Systems for Biogas

## [Economic Support Data ]

### ● **Feed-in tariffs**

- FIT system had been implemented until 2011.
- RPS (Renewable Portfolio Standard) system has been enforced since 2012.

### ● **Investment grants**

- When the private sectors build AD plants (using feedstocks from agriculture), the Government supports 60-80% of the total investment cost.
- All biowaste AD plants have been built and operated by the Government

### ● **Taxes**

- There is no tariffs or subsidies on biogas. However 10% VAT (Value Added Tax) and 2% tariffs will be charged when the mixture of CNG and biogas is sold.

# National Strategies

## RPS (Renewable Portfolio Standard)

RPS system has been implemented **since 2012**. As “Mandatory Supply Quantity (MSQ)”, 2% of the total power generation should be supplied using the appropriate kind of renewable energy.

There is a governmental target to increase MSQ up to **10% of the total power generation in 2022**.

## RFS (Renewable Fuel Standard)

Renewable Fuel Standard (RFS) system for biogas is expected to be **implemented in 2017**

# Biogas Research

## ● **Research Activities(Biogas projects)**

### **(1) Animal Manure to Biogas**

- Ministry of Agriculture, Food, and Rural Affairs has financially supported enterprisiers with 60% of the total construction cost of AD plants treating 70-100 m<sup>3</sup> of manure per day.
- 7 AD plants are now under construction and 12 more AD plants will be built until 2017.

# Biogas Research

## ● **Research Activities(Biogas projects)**

### **(2) Organic Wastes to Energy**

- Ministry of Environment (MOE) established a center for Organic Wastes to Energy.
- The total budget for the research project 2013-2020 (7 years) was \$74 million (MOE \$56.5 million and Private \$17.5 million) and following research results are expected;
- An actual AD plant for food waste of which capacity is 1,800m<sup>3</sup> would be constructed and presented. Research on biogas upgrading, the system development for odour control, O/M manual development for the AD plant and application of digestate.

# Biogas Research

## ● **Research Activities(Biogas projects)**

### **(3) Organic Wastes to Energy**

- Ministry of Trade, Industry and Energy
- The objective of the project is to develop the optimum anaerobic processes to deal with diverse substrates such as food waste, animal manure, and agricultural residues with regard to the operation with single and co-substrates depending on the organic loading rates(OLR).
- The final goal of the project focused on the development of the process control algorithm.
- The total budget for the project 2015-2018 (3years) is \$5.3 million

# Biogas Research

## ● **Research Trends**

- Wastes to biogas : wet and dry anaerobic digestion
- Co-digestion of biowaste : different raw materials
- Upgrading technology : membrane, in-situ methane enhancement
- Upgrading digestate as liquid fertilizer

*Thank you for your attention*

