



IEA Bioenergy Task 37

Korea Country Report

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IEA Bioenergy

Biogas Plant Inventory (2013)

Substrate/Plant type	Number of plants	Production* (GWh/year)
Sewage sludge	38	969
Biowaste (co-digestion)	16	249
Agriculture	7	10
Industrial	-	-
Landfills**	21	1,350
Total	82	2,578

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

** = based on 2012 data

A total of **82 biogas plants** are now in operation to produce **2,578 GWh per year**. Landfill biogas contributes 52.4%(1,350GWh/yr), biogas from sewage sludge 37.6%, biowaste 9.6% etc. Especially biowaste mainly consists of food waste, food waste leachate and digestible co-substrates.

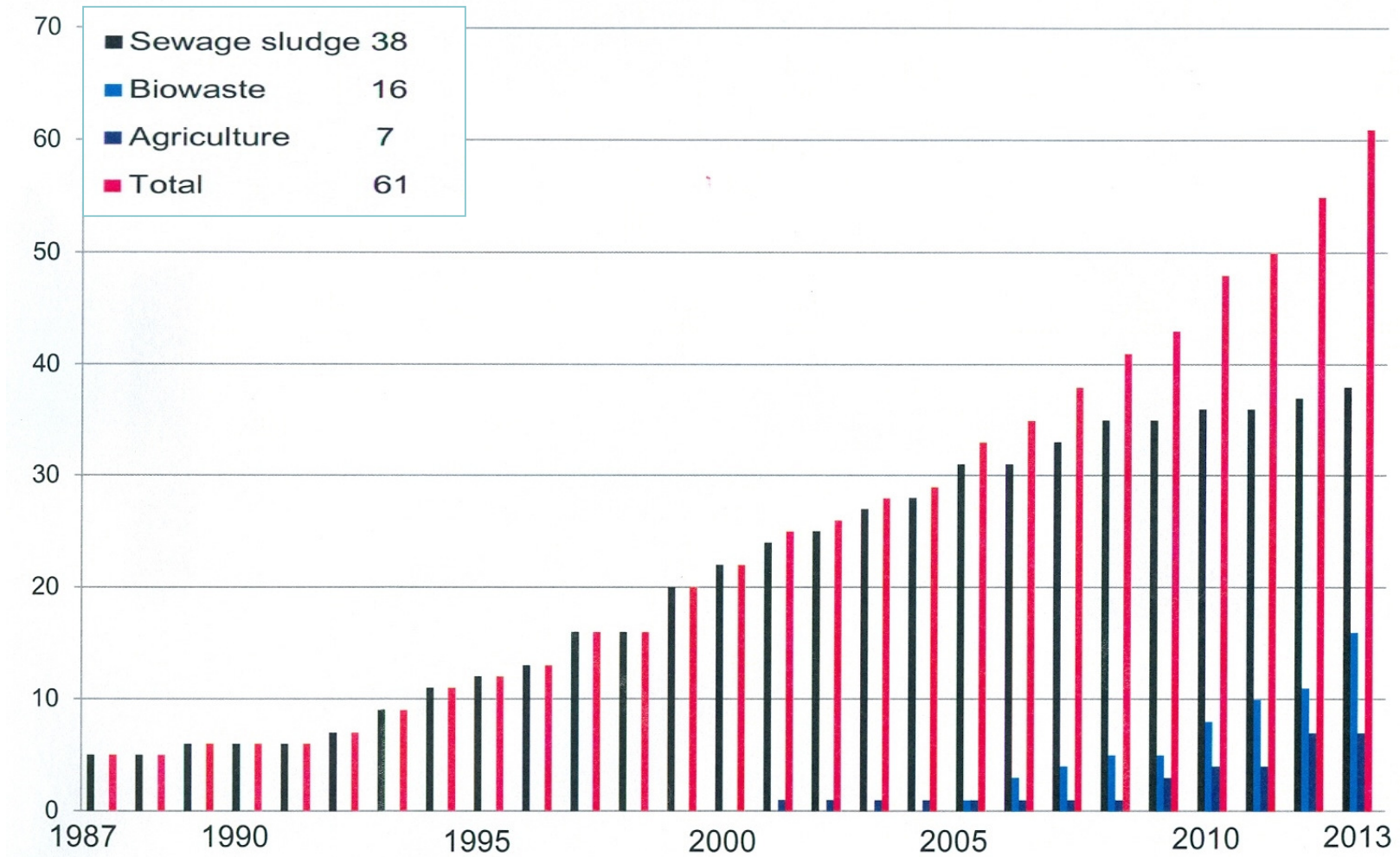
Biogas Plant Inventory (2013)

- Electricity generation from biogas plants amounted to only 39 GWh in 2012. The governmental goal is very slowly increasing; **64 GWh in 2020 and 161 GWh in 2030**, respectively.
- There are **15 new biogas plants under construction** to treat 4,764 tons of food waste and food waste leachate daily to produce **454GWh by 2017**. The electricity generated **from LFG reached 419 GWh** in 2012.
- 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 ³ /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	15	11	31
Planned	16	15	13	44

Biogas Utilization (1)

Utilization	GWh	%
Electricity	1,517	58.8
Heat	618	24.0
Vehicle fuel	26	1.0
Flare	280	10.9
Biogas sale	137	5.3
Total	2,578	100

Biogas Utilization (2)

- **About 59% (1,517 GWh)** of the biogas is utilized **for electricity production**. **The main part (24%, 618GWh)** 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 **(11%)**. The utilization of biogas as vehicle fuel is only 1.0% of the total biogas production.
- **Number of buses using CNG as a vehicle fuel reached 30,924** 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 sector builds AD plants (with raw materials 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 a 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 **8% of the total power generation in 2020**.

RFS (Renewable Fuel Standard)

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

Performance and Economic Data

Performance Data :

- electrical efficiency : 28~35%
- total energy efficiency : 70~80%
- methane emissions (Biowaste) : ??

Economic Data :

- Construction Costs
 - AD plant (Biowaste 150 t/d) : 17,600,000 USD
 - Up-grading (600 Nm³/h) : 3,088,000 USD
- Operating Costs (Biowaste 150 t/d) : 1,250,000 USD
(excluding earned benefit)

Obstacles for the Biogas Development

● Obstacles and Challenges

- AD plant permitting : Public resentment, Financial problem
- Environmental licenses : odour control
- Grid connections (electricity, heat, gas pipeline) :
→ Cooperation with gas company who owns gas pipeline
- Digestate utilisation : Public grievance of sprinkling liquid fertilizer

Biogas Research

● Research Activities(Biogas projects)

Animal Manure to Biogas Project

- Ministry of Agriculture, Food, and Rural Affairs has financially supported enterprises with 60% of the total construction cost of AD plants treating 70-100 m³ of manure per day.
- 6 AD plants are now under construction and 11 more AD plants will be built until 2020.

Biogas Research

● Research Activities(Biogas projects)

Organic Wastes to Energy Project

- 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 with capacity of 1,800m³ will be constructed and presented. Research on biogas up-grading, the system development for odour control, O/M manual development for the AD plant and application of digestate.

Biogas Research

Research Trends

- Wastes to biogas : wet and dry anaerobic digestion
- Co-digestion of biowaste : different raw materials
- Up-grading technology : membrane, in-situ methane enhancement

Thank you for your attention

