TECHNOLOGY FACTSHEET

SMALL-SCALE ANAEROBIC MONO-MANURE DIGESTION FOR ELECTRICITY AND HEAT PRODUCTION (CHP)

Date of factsheet	3-9-2018
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Sector	Agriculture: Other
	Refers to green gas production from manure in the Netherlands.
ETS / Non-ETS	Non-ETS
Type of Technology	Biomass
Description	The data refers to small scale 100% manure installations. The manure, at the farm level, is fermented in an anaerobic digestion installation to produce biogas. The biogas is fed into a cogeneration unit to produce electricity and heat. Biogas is a blend of methane (50–75% CH_4) and carbon dioxide (25-50% CO_2) with some trace amounts of ammonia (NH_3), hydrogen sulphide (H_2S), and water. Digestate is often separated into a thick and thin fraction. The thick fraction can then be hygienized to make it safe for use or export as a fertilizer. The hygienisation prior to export is mandatory. During hygienisation, the digestate is kept at a temperature of at least 70°C for one hour. The thin aqueous fraction can be further purified to a concentrated fraction and water.
TRL level 2020	TRL 9
	AD technology is a widely applied commercial technology.

TECHNICAL DIMENSIONS

	Functional Unit	Value and Range		
Capacity	MWth	0.12		
		0.12	-	0.12

	Functional Unit	Current			2030			2050		
Potential	MWth	-			-			-		
		Min	-	Max	Min	-	Max	Min	-	Max
Market share	%	-			-			-		
		Min	-	Max	Min	-	Max	Min	-	Max

Capacity utlization factor	1
Full-load running hours per year	8,000
Unit of Activity	
Technical lifetime (years)	15
Progress ratio	-
Hourly profile	
Explanation	Both the capacity and the potential refers to MWth biogas. Thus, the potential is presented as biogas potential of manure and it is the same for all small scale mono manure digestion related pathways. Since the focus is on farm level mono-manure installations we don't consider any possibilities to import manure. The figures from Elbersen et al, (2015) refer to liquid whereas DNV GL refers to bothliquid and solid manure. We, therefore, assumed that 90% of the total refers to liquid manure in the DNV GL study.

COSTS

Year of Euro: 2015

	Euro per Functional Unit	Current			2030			2050		
Investment costs	mln. € / MWth	3.26			3.04			2.86		
		2.77	-	3.26	2.60	-	3.04	2.29	-	2.93
Other costs per year	mln. € / MWth	-			-			-		
		Min	-	Max	Min	-	Max	Min	-	Max
Fixed operational costs per year (excl. fuel costs)	mln. € / MWth	0.19			0.19			0.18		
		0.11	-	0.19	0.10	-	0.19	0.09	-	0.18
Variable costs per year	mln. € / MWth	0.01			0.01			0.01		
		0.01	-	0.01	0.01	-	0.01	0.01	-	0.01

Costs explanation: MWth refers to MWth biogas input. Feedstock price at the port is assumed as zero. The CAPEX and OPEX includes all the necessary processes to produce biogas and the cogeneration unit to produce electricity and heat. Costs related to treatment of digestate and wastewater are excluded. The costs data are converted to 2015 as they were from 2018. Once the technology is implemented there can be some cost reductions. ETRI indicates cost reduction for AD to be in the range of 2,1%-0,5% per year for the first 5 years and 0,1-0,6% per year for the following years. We apply the baseline cost reduction rates of ETRI to SDE+2019 data. It is important to highlight that ETRI does not distinguish between mono- all digestion. Next to that, they only refer to AD related CAPEX and OPEX, whereas we also include further processing of biogas into green gas. ETRI indicates cost reduction for AD to be in the range of 2,1%-0,5% per year for the first 5 years and 0,1-0,6% per year for the following years. We apply the baseline cost reduction rates of ETRI for small scale mono digestion. It is important to highlight that ETRI does not distinguish between mono- all digestion. Next to that they only refer to AD related CAPEX and OPEX, whereas we also include the cogeneration unit. The generic biomass input and techno-economic data in the SDE are as follows. Biomass energy content: 0,63 GJ/ton; net price of feedstock at the gate is assumed as zero. Other necessary utility costs (i.e. electricity) are covered within the fixed O&M costs.

ENERGY IN- AND OUTPUTS

Energy carriers (per unit of main output)

Energy carrier	Unit	Current			2030			2050		
Main output: Electricity	PJ	-0.32			-			-		
		-0.32	-	-0.32	Min	-	Max	Min	-	Max
Heat	PJ	-0.32			-			-		
		-0.32	-	-0.32	Min	-	Max	Min	-	Max
Biogas (manure)	PJ	1.00			-			-		
		1.00	-	1.00	Min	-	Max	Min	-	Max
	PJ	-			-			-		
		Min	-	Max	Min	-	Max	Min	-	Max

Energy in- and Outputs explanation: In SDE+ the generic energy content of manure is assumed as 0,63 GJ/ton. The internal heat demand (around 18% biogas burned in a boiler) is met via a certain share of heat produced. That is why the useful heat production is low.

MATERIAL FLOWS (OPTIONAL)

Material flows

Material	Unit	Current			2030			2050		
Digestate	%volume	0.80			-			-		
		0.80	-	0.80	Min	-	Max	Min	-	Max
		-			-			-		
		Min	-	Max	Min	-	Max	Min	-	Max

Material flows explanation: Digestate can be separated into a thick and thin fraction. The thick fraction can then be hygienized to make it safe for use or export as a fertilizer. The hygienisation prior to export is mandatory. During hygienisation, the digestate is kept at a temperature of at least 70°C for one hour.

EMISSIONS (Non-fuel/energy-related emissions or emissions reductions (e.g. CCS)

Emissions

Substance	Unit	Current			2030			2050		
CH_4	Mton CO_2-eq	-0.08			-			-		
		-0.08	-	-0.08	Min	-	Max	Min	-	Max
		-			-			-		
		Min	-	Max	Min	-	Max	Min	-	Max
		-			-			-		
		Min	-	Max	Min	-	Max	Min	-	Max
		-			-			-		
		Min	-	Max	Min	-	Max	Min	-	Max

Emissions explanation: IBO study indicates the methane emission saving factor as 0,068 ton CO_2-eq/ton mest. The total methane emission saving is based on the amount of manure with a biogas content of 1 PJ. Manure energy content is assumed as 0,63 GJ/ton. The manure input is calculated as 1/0,63*1000.

OTHER

	Current			2030			2050		
Other	-			-			-		
	Min	-	Max	Min	-	Max	Min	-	Max

REFERENCES AND SOURCES

SDE+ Eindadvies 2019

DNV GL, 2017. Biomassapotentieel in Nederland Verkennende studie naar vrij beschikbaar biomassapotentieel voor energieopwekking in Nederland. Paula Schulze, Johan Holstein, Harm Vlap. GCS.17.R.10032629.2

ETRI study. 2018. Cost development of low carbon energy technologies. Scenario-based cost trajectories to 2050, 2017 edition.

IBO study