



Technology Description (TD) for Biogas Upgrading Technologies

Contact Information:

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<i>Date (of filling the TD):</i>	06/06/2017			

Technology Description:

NAME OF TECHNOLOGY	BioGame
ASSIGNMENT OF TECHNOLOGY	Biogas upgrading (VSA)
TECHNICAL READINESS LEVEL	5
<p>TRL 1 - basic principles observed</p> <p>TRL 2 - technology concept formulated</p> <p>TRL 3 - experimental proof of concept</p> <p>TRL 4 - technology validated in lab</p> <p>TRL 5 - technology validated in relevant environment (industrially relevant environment in case of key enabling technologies)</p> <p>TRL 6 - technology demonstrated in relevant environment (industrially relevant environment in case of key enabling technologies)</p> <p>TRL 7 - system prototype demonstration in an operational environment</p> <p>TRL 8 - system completed and qualified</p> <p>TRL 9 - actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)</p>	
TECHNOLOGY/EQUIPMENT AVAILABILITY	We have one prototype with a maximum 0.5 m ³ /h flow rate
PATENT RIGHTS	NO

METHOD OF MAKING THE TECHNOLOGY AVAILABLE	<i>Licence selling</i>	NO
	<i>Licence granting</i>	NO
POSSIBLE END USERS OF TECHNOLOGY	<i>Please name end users/ contacts that should be invited to project workshops</i>	<ul style="list-style-type: none"> • 1st stage: partner industries and research institutes to develop the technology. • 2nd stage: small and medium size anaerobic digestion plants

Description of the technology/equipment: *(Pls. describe the technology. You may include pictures or graphics.)*

BioGame is an upgrading technology leveraging on Vacuum Swing Adsorption (VSA) process based on natural zeolites (i.e. tuffs).

AzzeroCO2 together with CNR-IIA (Consiglio Nazionale delle Ricerche – Istituto Inquinamento Atmosferico) developed a prototype that can operate with a maximum flow rate input of 0.5 Nm³/h (0.64 kg/h).

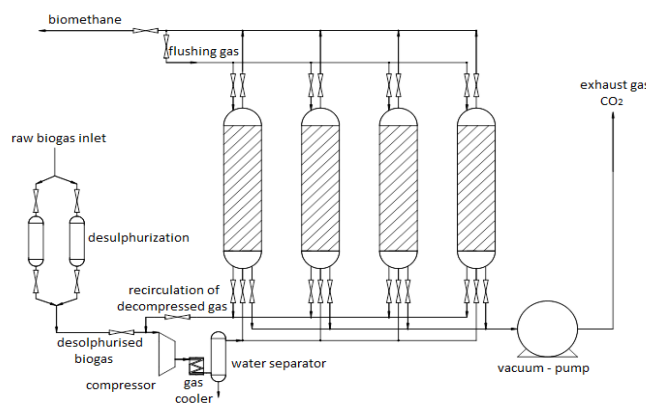


Figure 1 VSA upgrading plant layout

The main advantage of BioGame is the use of natural zeolites such as tuff as adsorbing material for the upgrading step, because of its large availability (waste from building industry and tuff quarries) and high resistance to impurities.

The process undergoes 6 steps (1-feed, 2-depressurization 3- blow down 4-purge, 5-equalization, 6-pressurization) and the presence of 4 adsorbing columns guarantee the continue methane flow.



Technical Data:

			Comments (e.g. which condition does the entered value correspond to?)
<i>Technical efficiency</i>	Methane content in raw gas (%)	≈50%	
	Methane content in product gas (%)	>98%	
<i>Capacity</i>	Flow rate (range) /upgrade capacity (Nm ³ raw gas/ h)	Up to 0.5 Nm ³ /h	
	Flow rate biomethane (Nm ³ /h)	Up to 0.25 Nm ³ /h	
	Possible range for upscaling	Up to 500 Nm ³ /h	
<i>Data for assessment of economical added value, possible contribution to GHG-reduction and flexibility</i>	Electricity demand (kWh _{el} /Nm ³ raw gas)	4 kWh _{el} / Nm ³	
	Heat demand (kWh _{th} /Nm ³ raw gas)	None	
	Chemical/additives demand (kg/h or kg/Nm ³ raw gas)	None	
	Demand of other substances (kg/h or kg/Nm ³ raw gas)	None	
	Biomethane slip (range in % of biomethane production)	<5%	
	Delivery pressure (bar _{abs})	6 bar abs (must be integrated with a compressing unit)	
	Full load hours (h/a)	8600 h (not validated)	
	Exhaust gas treatment	Emission in the atmosphere (can be integrated with a flaring unit to remove methane slip)	
	Usable heat (external) through heat extraction (kWh _{th} /Nm ³ raw gas)	No	Please indicate temperature
	Space requirement (m ²)	25 m ²	
Staff requirement (without	n.d.		



	maintenance) (h/a)		
	Capital costs (€)	n.d.	
	Maintenance costs (including spare parts such as new membranes, staff) (€/a or €/operating hour)	n.d.	
	Production costs (€/Nm ³ biomethane)	n.d.	
	Expected lifetime of unit (years)	30 years	
<i>Flexibility</i>	Necessity for adaptations of other parts of the plant		
	Advantages/disadvantages of technology	<ul style="list-style-type: none">• high methane purity;• low methane losses;• very low cost of adsorbent;	
	Special application area of technology	Small scale biogas plants	

Data Usage:

I agree that the above data can be published on the “Biomethane Map” www.biomethane-map.eu and to the further use for other possible scientific purposes.

Signature: