



Technology Description (TD) for Biogas Upgrading Technologies

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Technology Description:

NAME OF TECHNOLOGY	BKP Biogas Upgrading unit		
ASSIGNMENT OF TECHNOLOGY			
TECHNICAL READINESS LEVEL			
TRL 1 - basic principles observed TRL 2 - technology concept formulated TRL 3 - experimental proof of concept TRL 4 - technology validated in lab TRL 5 - technology validated in relevant environment (industrially relevant environment in case of key enabling technologies) TRL 6 - technology demonstrated in relevant environment (industrially relevant environment in case of key enabling technologies) TRL 7 - system prototype demonstration in an operational environment TRL 8 - system completed and qualified TRL 9 - actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)	9		
TECHNOLOGY/EQUIPMENT AVAILABILITY			
PATENT RIGHTS	YES		
METHOD OF	<i>Licence selling</i>	NO	



MAKING THE TECHNOLOGY AVAILABLE	<i>Licence granting</i>	NO
POSSIBLE END USERS OF TECHNOLOGY	<i>Please name end users/ contacts that should be invited to project workshops</i>	

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

Metener Biogas upgrading units utilize a traditional counter current water absorption technique to remove unwanted components from biogases making the system simple and robust. Biogas upgrading units are completely autonomous and controlled by PLC unit. Sensors monitor the performance of the process and adjust the conditions when needed. Most parameters such as absorption pressure and raw gas to water flow ratio are preset at the factory and fine tuning can be made at installation site according to requirements and raw gas properties. If the upgrading unit has internet connection provided at installation site the remote operation and monitoring is possible.

The upgrading unit needs electricity and water for the upgrading process. No chemicals are needed in the process except during the cleaning of the system. For safety, special odorant chemical is injected to the upgraded gas to detect gas leaks from pressurized components including the vehicles. Normally 18 mg/m³ of odorant chemical is added to give gas distinctive odor as otherwise the upgraded biogas would not have any odor at all.

Water usage is minimal as the process water is recycled in with efficient desorption and treatment system. Process water is changed during the cleaning operation every 1000 hours and at normal daily operations water is only added to compensate vaporization losses from the gas desorption (few liters per hour).

Water pump and raw gas compressor are both VSD-controlled (variable speed drive) to optimize electricity consumption at any given process condition. Electric power required by BKP10 upgrading unit is approx. 0.45-0.50 kWh/Nm³ raw gas entering the unit including final pressurization of upgraded gas to 200 bar with VRA-unit. With Metener high pressure booster compressor connected to upgrading, electric power is significantly lowered by increased efficiency (0.37-0.43 kWh/ Nm³ raw gas entering the unit including pressurization of upgraded gas to 250 bar) (table 2.).

Metener has developed high pressure double acting hydraulic booster which can be connected to higher flow rate upgrading units (25-200 Nm³ hr⁻¹). Metener has experience of hydraulic gas pressurization since 2002. The booster units are the result of long development and refinement of materials and they have had tens of thousands of hours continuous usage.



The advantages of hydraulic booster are low maintenance costs, low specific energy consumption and a wide range of available inlet pressures. Only wearing part of the booster are the piston seals which can last years before needing replacement. Depending the initial and final pressure one to four stages can be connected into series and gas is cooled between the stages.

Table 2. Comparison of BKP- upgrading units

UPGRADING UNITS	BKP10	BKP60	BKP120
Electrical power	5.0 kW	25 kW	50 kW
Water consumption	0.2-0.5 liter hour ⁻¹	2-3 liter hour ⁻¹	3-5 liter hour ⁻¹
Raw gas flow rate	10 m ³ hr ⁻¹	60 m ³ hr ⁻¹	120 m ³ hr ⁻¹
Energy consumption including pressurization 200 bar	0.45-0.50 kWh Nm ⁻³ raw gas	0.37-0.42 kWh Nm ⁻³ raw gas	0.35-0.40 kWh Nm ⁻³ raw gas
CO ₂ removal efficiency	95-98 %	95-98 %	95-98 %

The upgraded gas needs to be dried before high pressure compression to 200 bar. For the drying special desiccant media is utilized to lower the dew point to a level required for the vehicle use. Dew point analyser is used to indicate the need for desiccant media swab and regeneration. The upgrading unit can be equipped with automatically regenerated dryer system which has two desiccant cylinders, one in adsorption mode and other in desorption mode.

