MemBrain®

Biogas upgrading to BioCNG/Biomethane

Brož P., Maršálek J., Bobák M.

Membrain, s.r.o.

Membrane Innovation Center

MemBrain belongs to the MEGA group

MemBrain®

Fields of activity

Processes based on membrane separations

Liquids

- *Desalination of industrial waters*
- *Removing of organic substances, eg amino acids*
- *Production of ultrapure water*
- *Whey desalination*

Gases

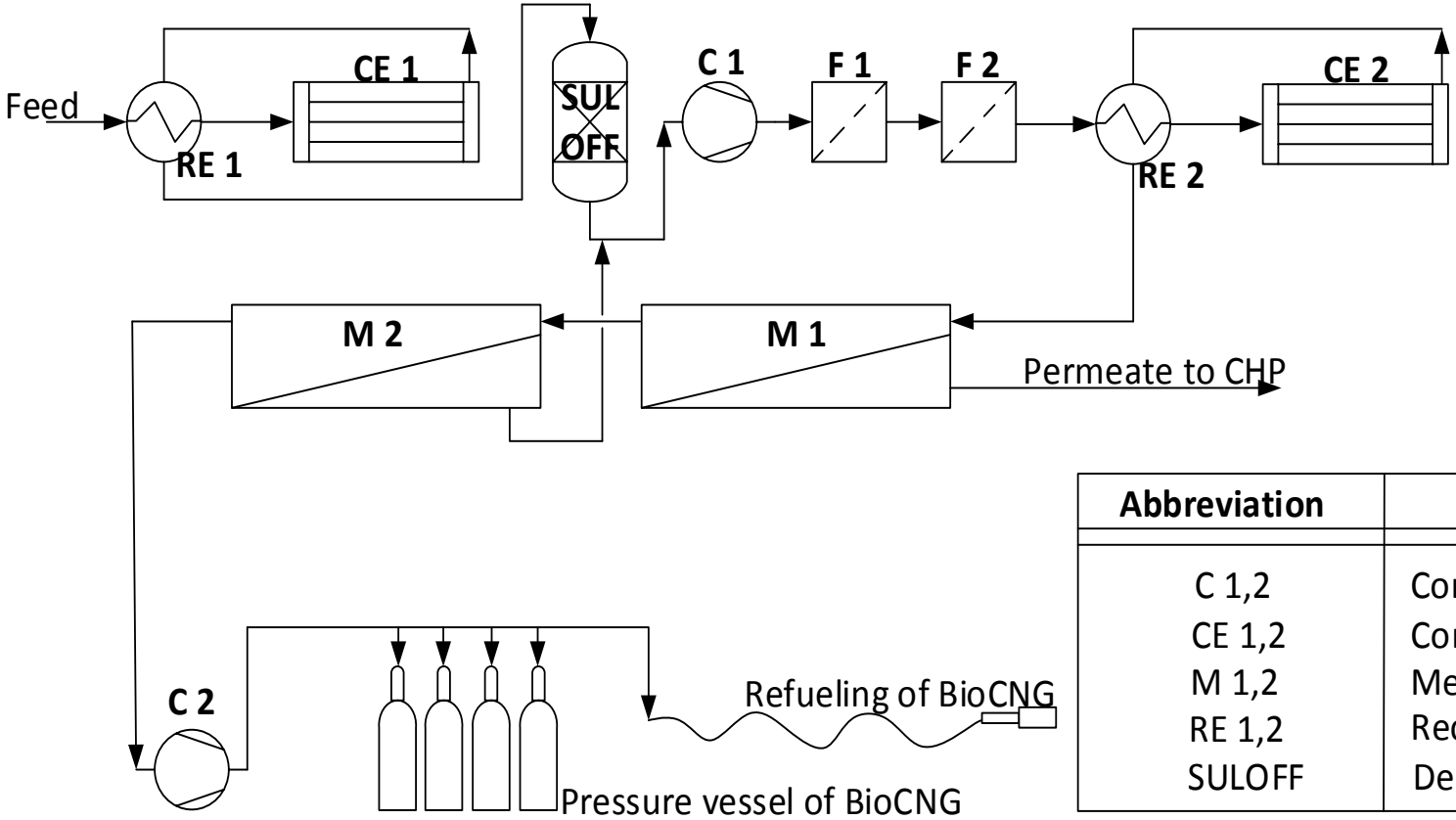
- *Separation of biomethane*
- *Separation of nitrogen from air*
- *Separation of hydrogen from ROG*
- *Adjusting synthesis gas ration*

PRODUCTION OF BioCNG (BIOMETHANE)

- **Advantages of using membrane separation**
  - Small built up area
  - Minimum service requirements
  - Low consumption of energy
  - Continuous operation
  - High flexibility in fluctuations in flow and composition of biogas
  - Simple capacity expansion
  - Quick start up
- **Disadvantage**
  - Guaranteed of membrane lifetime is 5 years

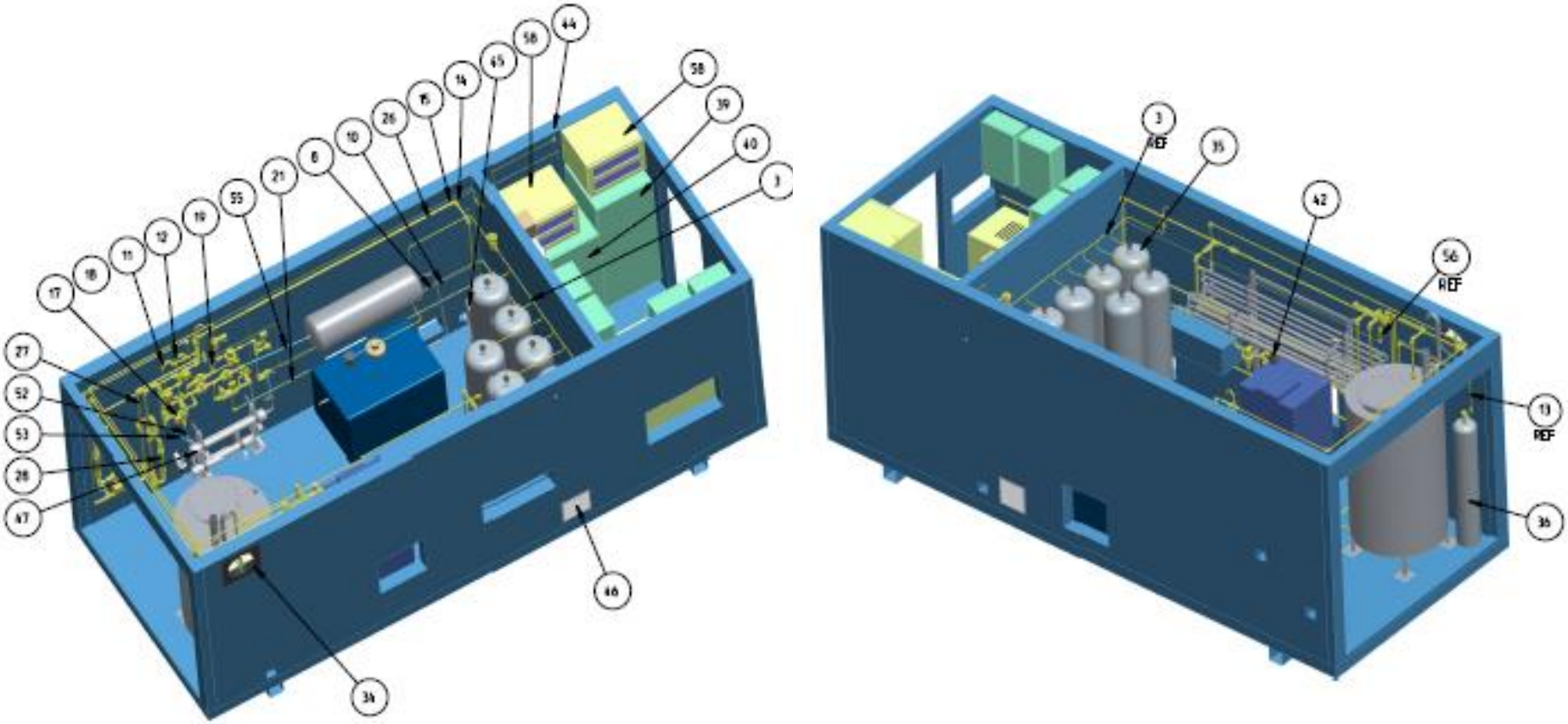
MemBrain®

Basic elements of BioCNG technology



Abbreviation	Key
C 1,2	Compressor 1, 2
CE 1,2	Condens. Exchanger 1,2
M 1,2	Membrane module 1,2
RE 1,2	Recuper. Exchanger 1,2
SULOFF	Desulphurization column

View of BioCNG technology in container



Placing of pilot unit on WWTP Modřice

COMMERCIAL UNITS BioCNG (BIOMETHANE)

- ***Tab.1.*** Standard series of performance

Biogas flow	Nm^3/h	25	50	100	200	250	500	1000
Concentration CH_4 in biogas	obj.%	51 - 65	51 - 65	51 - 65	51 - 65	51 - 65	51 - 65	51 - 65
Biometan production	Nm^3/h	13 - 17	26 - 34	53 - 68	to 135	to 169	to 338	to 677
Biometan	Kg/h	9 – 12	18 - 24	37 - 48	75 - 95	to 118	to 237	to 474

- Two-stage, or three-stage of biomethane separation
  - two-stage – permeate containing 5 – 20 vol.% CH_4
  - three-stage – permeate containing 0,3 – 0,5 vol.% CH_4

Quality of BioCNG and biomethane in CZ

- BioCNG, the national standard CSN no. 656514
  - Type LH: content of CH4 96 – 98 vol.%
    Wobbe number 44,7 – 46,4 MJ/m3
    Dew point t - 5°C
    Total content of sulphur 10 mg/m3
  - Type H: content of CH4 95 – 99 vol.%
    Wobbe number 43,9 – 47,3 MJ/m3
- Biomethane, the national standard CSN EN 16723-2
  CH4 number index 65 (by the TPG 90202 min. 95% CH4)
  Total content of sulphur 30 mg/m3
  Dew point of water by the class A,B,C

Example of calculation of BioCNG unit

- ***Tab. 2.*** Calculation without subsidies, price of biogas 7,84 €/100 Nm^3, content CH_4 60 obj.%

Type of unit	Purchase price (mil. €)	OPEX (mil. €/y)	Costs of BioCNG (€/100Nm^3)	Price BioCNG (€/100 Nm^3)	Production price BioCNG (mil €/y)	Costs (mil. €/y)	Simple return (years)
BU 100	0,74	0,04	22,5	47,1	0,234	0,110	6,2
BU 100 (km/d)	Škoda G-Tec 21800			Iveco 3,5 t 9816		BUS 3272	

Example of calculation of biomethane unit

- ***Tab. 2.*** Calculation with subsidies for biomethane „green bonus“ price of biogas 15,68 €/100 Nm^3, content CH_4 60 obj.%

Type of unit	Purchase price (mil. €)	OPEX (mil. €/y)	Costs of biomethane (€/100Nm^3)	Price biometh. (€/100 Nm^3)	Production price biometh. (mil €/y)	Costs (mil. €/y)	Simple return (years)
BU 100	0,74	0,04	36	62,7	0,302	0,161	5,2

CONCLUSION

- BioCNG (biomethane) production technology has been proven by company Membrain ans is commercially viable.
- Each unit can be specifically designed according to customer specification.
- We can designed small unit from 25 Nm^3/h for BioCNG and biomethane production (mainly for medium pressure network around 4 bars)

CZECH REPUBLIC

Thank You for your attention

MemBrain s.r.o.

Pod Vinicí 87, 471 27 Stráž pod Ralskem

+420 487 805 201

info.membrain@membrain.cz

www.membrain.cz