



## Mobile plant for liquefaction of BIOMETHANE



# Mission statement

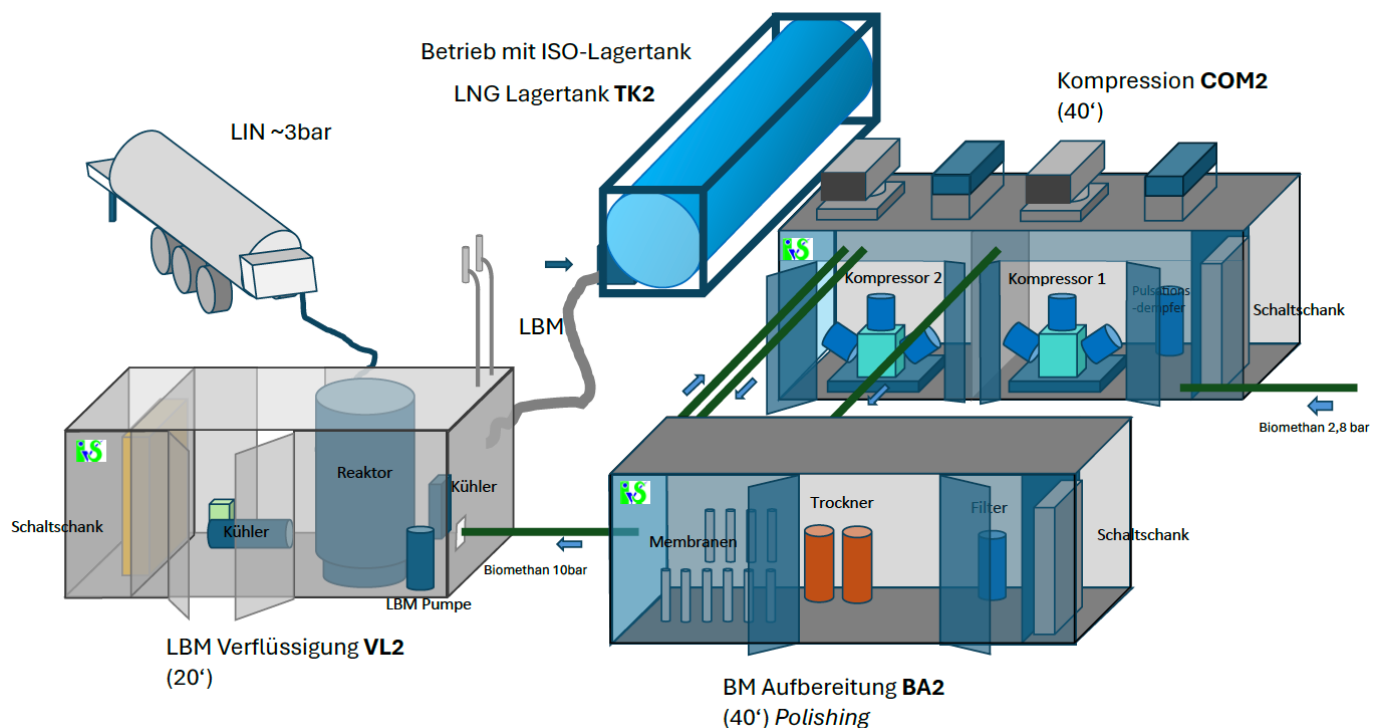
Developments in the energy market require the expansion of biomethane production to a considerable extent.

For this purpose, **lvS** has developed a biomethane liquefaction plant that can be used to liquefy biomethane from existing biogas plants.

The liquefaction plant should be compact and easy to transport.

On the basis of this task, a concept for a container-based system was developed in cooperation with MHC Holding GmbH.

The plant operates on the basis of a LIN liquefaction process and therefore has only a low power requirement.



Biomethane liquefaction – basic structure

As a mobile plant, the liquefaction system usually receives an operating permit of 12 months.

However, it can also be approved as a fixed installation.

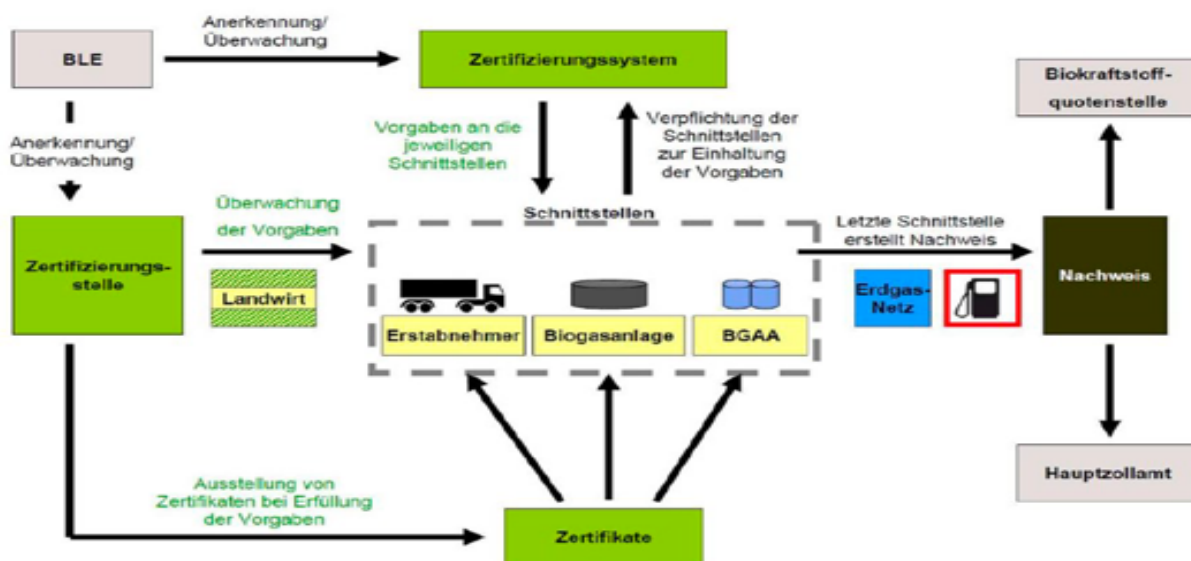
# Mission statement

The liquefied biomethane (LBM) can then be transported to the customer in the ISO container.

If the right biomass/substrates are used, in Germany, **THG quotas** can be charged when this LBM is used as a fuel for transport.

With this plant size of 500 Nm<sup>3</sup>/h (approx. 8.4 tons LBM/day), quotas of over 12 Mln per year can be achieved.

We are also able to provide you with buyers for this gas with longterm contracts.



**Abb. 5:** Nachweiserbringung für Biomethan

Quelle: geändert nach „Biomethan als Kraftstoff: Eine Handlungsempfehlung zur Biokraft NachV für die Praxis“, Heidelberg/Berlin, Oktober 2010, S. 14

# Assumptions

It is assumed that this plant can be connected to existing biogas plants with gas upgrading.

The biomethane to be processed should meet the quality of **DVGW G260**.

## Basic structure:

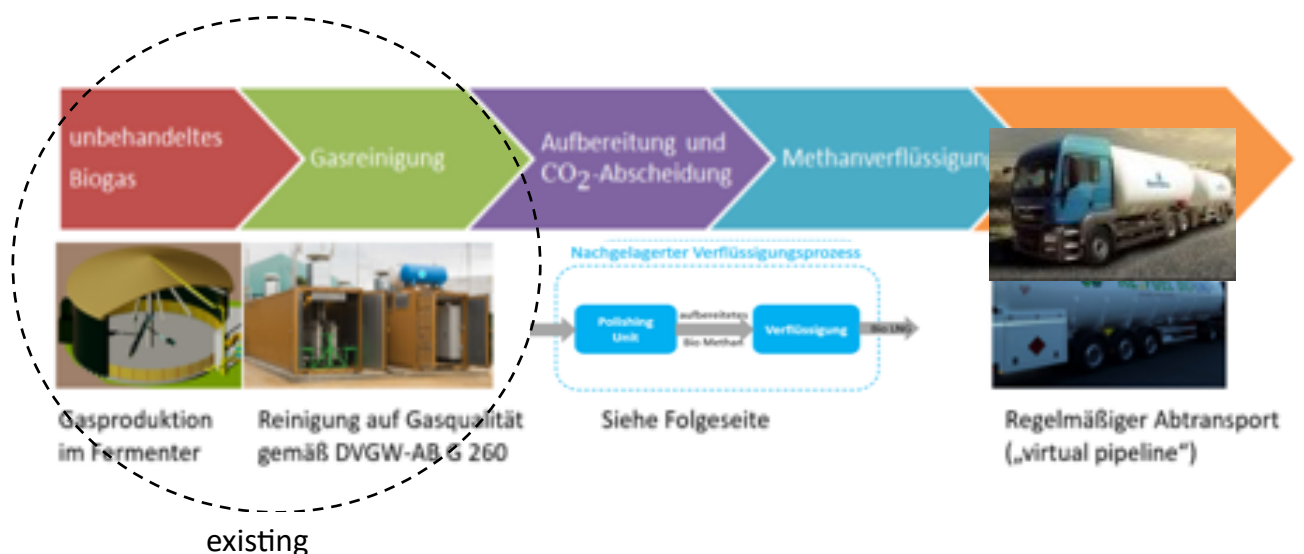
The biomethane is to be brought to the quality required for the liquefaction process by means of a polishing unit (gas processing plant).

### Input Quality Polishing Unit (Processing):

- approx. 530Nm<sup>3</sup> /h      ca. 360kg Biomethan ( $\geq 97.0\%$  CH<sub>4</sub>)
- CO<sub>2</sub> content              < 3%
- Pressure                     $\geq 12\text{bar}$
- Temperatur                +25 to 37°C

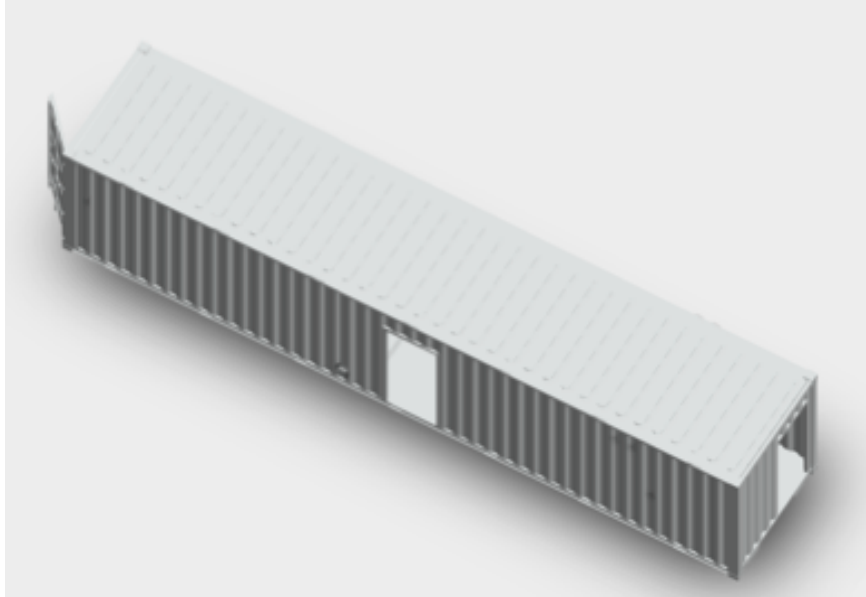
### Input quality liquefaction:

- approx. 500Nm<sup>3</sup> /h      < 350kg reines Biomethan (99,9% CH<sub>4</sub>)
- CO<sub>2</sub> Gehalt                Max. < 50 ppm
- Pressure                     $\geq 10\text{bar}$
- Temperatur                +37°C max.



# Concept of Polishing Unit

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The entire system is housed in a 40 foot container and consists of the following components:

- Gas inlet with gas quality control CO<sub>2</sub> and H<sub>2</sub>O
- 2-stage membrane system with filter
- Gas drying plant
- Gas output with gas quality control CO<sub>2</sub> and H<sub>2</sub>O
- Control valves
- Electrical control cabinet in the control room (EX-free area)

## Medium Inputs:

- Input biomethane G260 < 360kg/h, 12 bar, +25°C bis 37°C

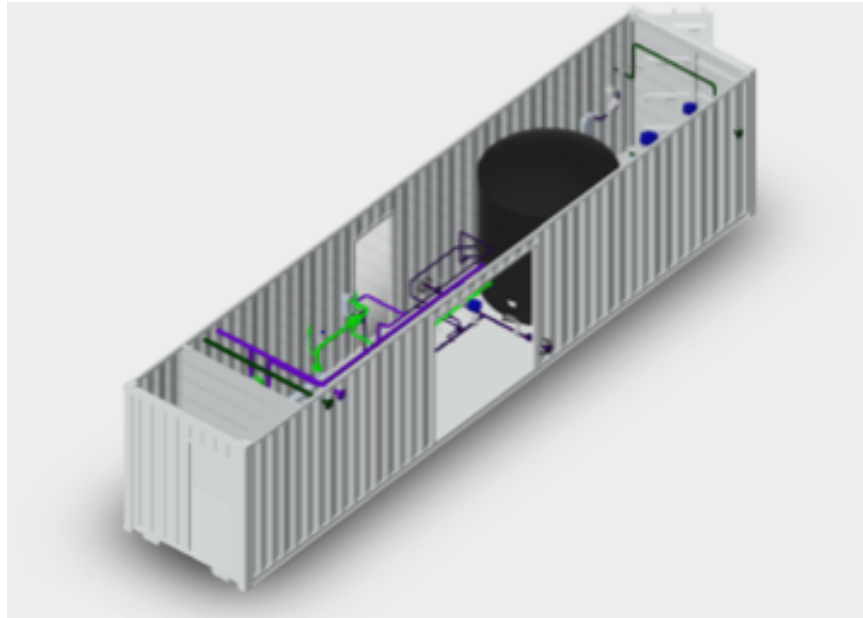
## Medium Outputs:

- Output biomethane up to 350kg/h, 10 bar  
- Return to biogas upgrading: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub> ~28Nm<sup>3</sup>/h max., <1.5bar as an alternative to the optional CHP unit

## Operation:

The plant receives biomethane from the biogas upgrading plant. This is further processed by means of membranes and then fed to the liquefaction plant.

# Concept of liquefaction



The liquefaction plant is housed in a 40 foot container and consists of the following components:

- A vacuum-insulated cryogenic tank (reactor) – max. operating pressure 16bar
- An LNG pump outside the cryogenic tank
- heat exchangers
- Control valves
- Electrical control cabinet in the control room (EX-free area)

## Medium Inputs:

- Input of pure biomethane < 350kg/h, 12 bar, +37°C max.
- Input LIN ~ 700kg/h, 3bar, -196°C
- Charging line LNG/LBM only during startup

## Medium Outputs:

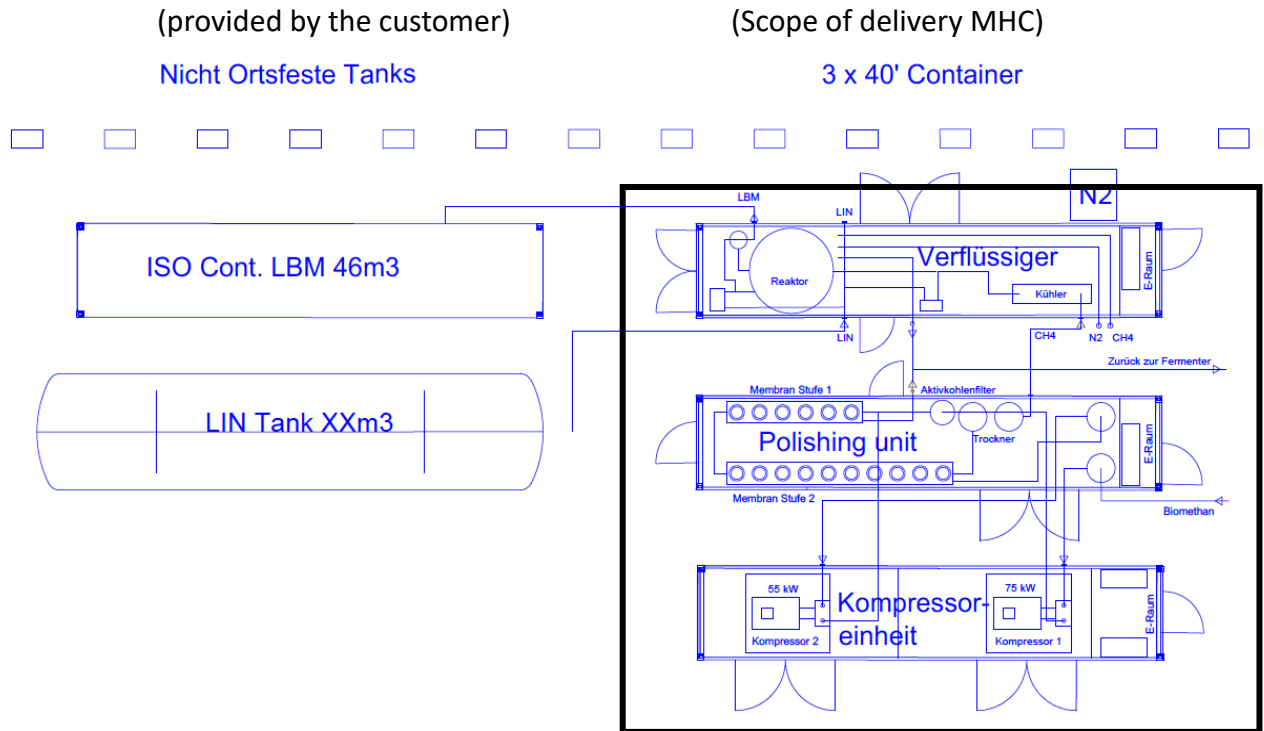
- Biomethane output (LBM) < 347kg/h, < 10bar
- Output N2 ~ 700kg/h, < 1bar (>-100°C)  
Blow out into atmosphere and/or to consumers.

## Operation:

The plant receives processed biomethane from the polishing unit. This is liquefied supported by LIN cooling and pumped into a connected storage facility (ISO container). The required LIN can be stored in a cryogenic tank or connected by tanker.

# Floor space

## Example



The overall installation is planned as **NON-STATIONARY** and can be erected on any paved area without major construction work.



# Pilot plant

## Preparation





# Pilot plant

Liquefaction



# Pilot plant

## Liquefaction



## Pilot plant

## Liquefaction HMI







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