INT-Energia Kft. Metaplasma S.L.

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Technology

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# BIOGAS DEEP TREATMENT SYSTEM – PRODUCTION OF HIGH-PURITY BIOMETHANE AND BY-PRODUCTS


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# *Single-Stage Biogas Deep Purification System*

## 1. What the System Represents

he single-stage biogas deep-purification system is a modular unit installed on existing biogas plants without any modification to fermenters.

The module provides:

- purification of biogas to 98–99.5% $CH_4$;
- complete utilisation of $CO_2$;
- conversion of $CO_2$ and sulfur compounds into potassium carbonate ($K_2CO_3$) and calcium carbonate ($CaCO_3$);
- fully closed, zero-emission cycle (0% $CO_2$ emissions);
- heat recovery for drying biogas, final products and supplying external consumers.

The system implements patented methods of catalytic oxidation of impurities ($O_2$, $NH_3$), centrifugal gas cleaning, two-stage bubble and spray absorption, and chemical binding of $CO_2$ with KOH/$K_2CO_3$ solutions, followed by alkali regeneration and production of valuable products ($K_2CO_3$, $KHCO_3$, $CaCO_3$). This combination of processes enables complete biogas purification, full $CO_2$ utilisation and a fully closed, waste-free alkaline cycle.

## 2. Key Advantages

- 98–99.5% $CH_4$ — without membranes, PSA or amine solutions.
- $CO_2$ → valuable products (CCU): $K_2CO_3$ / $CaCO_3$.
- Deep sulfur removal: $H_2S$ < 5 ppm.
- Minimal reagent consumption — closed KOH–$K_2CO_3$–KOH cycle.
- Pilot system implemented in Spain (2024–2025).
- Equipment manufacturing in Hungary (Vác).

***Important: The installation is not the construction of a new plant; it is an upgrade of an existing one using a highly efficient module***

## .3. Effect on an Existing Biogas Plant (“Before / After”)

Before installation:

- $CH_4$: 55–70%
- $CO_2$: 25–45%
- $CO_2$ released into the atmosphere
- no useful products
- gas does not meet biomethane specifications

After installation:

- 98–99.5% $CH_4$ — biomethane
- $CO_2$ < 1% — converted into $K_2CO_3$ / $CaCO_3$
- $H_2S$ < 5 ppm
- zero $CO_2$ emissions

- generation of high-value products
- additional revenue streams for the plant

***The system operates autonomously and does not require any modification to fermenters.***

***Pilot single-stage biogas purification system with $CO_2$ utilisation and product recovery in Spain (2025)***

## 4. Priority Benefits for Hungary

- Increase in biomethane output without new plant construction.
- Establishment of domestic $K_2CO_3$ and $CaCO_3$ production (currently 100% imported).
- Full decarbonisation of the biogas sector — $CO_2$ converted into product.
- Alignment with Fit-for-55, RED III and the Net-Zero Industry Act.
- Export-capable Hungarian technology — modules manufactured in Hungary.
- Economics: 1–5 years payback.

## 5. Proven Performance (Spain, 2025)

Pilot results:

- $CH_4$: 99,1%;
- $CO_2$: < 1%;
- $H_2S$: < 5 ppm;
- stable production of $K_2CO_3$;
- high-purity $CaCO_3$ generation.

***Hungary-based production (Vác) — equipment prepared for export to Spaine***

## 6. Fast Integration

- delivery of a complete purification module;
- connection to existing gasholders;
- no shutdown of the biogas plant;
- installation and commissioning: 5 weeks;
- power consumption: 8–20 kW.

For implementation in Hungary, serial production of biogas purification systems with capacities of 100 $m^3$/h and 300 $m^3$/h has already been prepared, and technical documentation for the 600 $m^3$/h system is under development. The modular design allows rapid adaptation to plants of different capacities.

## *7. International Industrial Inspection (Bureau Veritas, 2025)*

In 2025, Bureau Veritas conducted an independent inspection of the Spanish pilot system and officially confirmed:

- compliance with all declared technical parameters;
- stable $CO_2$ reduction to design values;
- complete removal of $H_2S$ and acid impurities ($H_2S$ < 5 ppm);
- stable operation of all components under defined conditions;
- production of market-grade $K_2CO_3$ solution and $CaCO_3$ solid;
- capability of KOH regeneration and operation of the closed KOH–$K_2CO_3$–KOH cycle;
- measured throughput: 100 $m^3$/h;
- energy consumption: 11 kWh per cycle, confirming high efficiency.

***These results prove that the system is industrially reliable, scalable and fully compliant with EU biomethane and CCU requirements..***

## *8. International Interest*

Delegations from Spain, Germany and Italy visited the Spanish pilot plant. The visits confirmed the industrial maturity of the process and strong potential for EU-wide deployment.

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