



Biogas plant Methanation

General presentation

SECTION 1 — OPPORTUNITY

*Unlocking CO₂ value and new revenue streams
for biogas plants with Methanation*

The Opportunity in Biogas Plants

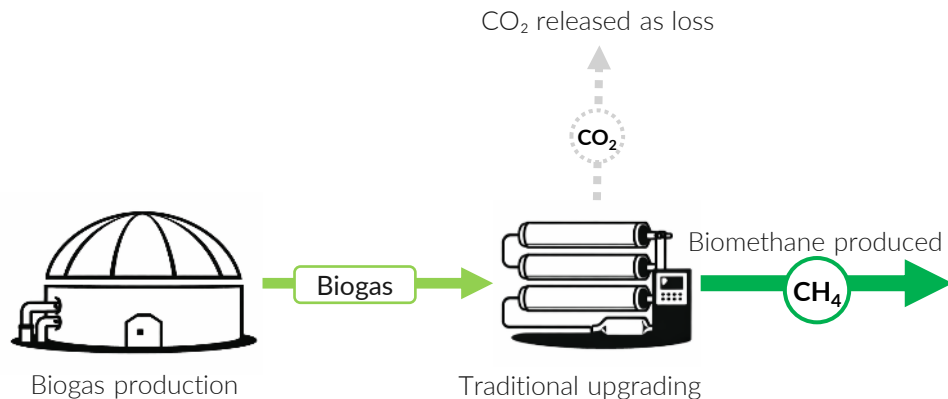


Biogas plants today are inherently carbon-rich systems where a significant share of carbon is released as CO_2 during upgrading. At the same time, regulatory and market developments are creating increasing value for **renewable methane** and **RFNBO** fuels.

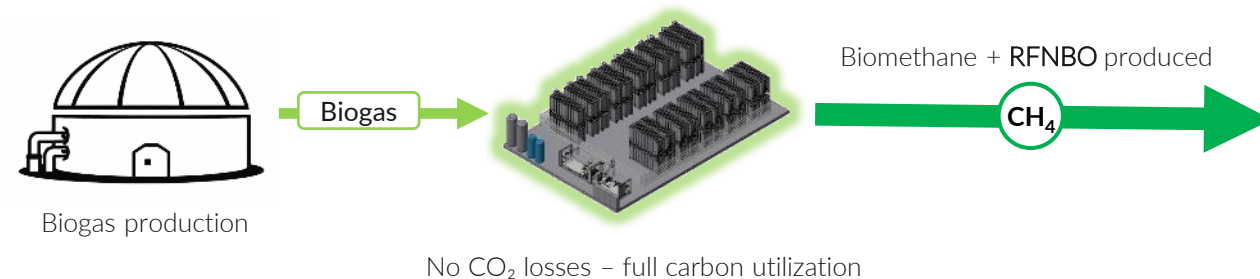
This creates a clear opportunity:

- Convert CO_2 into additional methane
- Increase plant output without increasing feedstock
- Access **premium fuel markets**

Conventional biogas upgrading



CO_2 -to-eMethane conversion



Why Now – Market Drivers



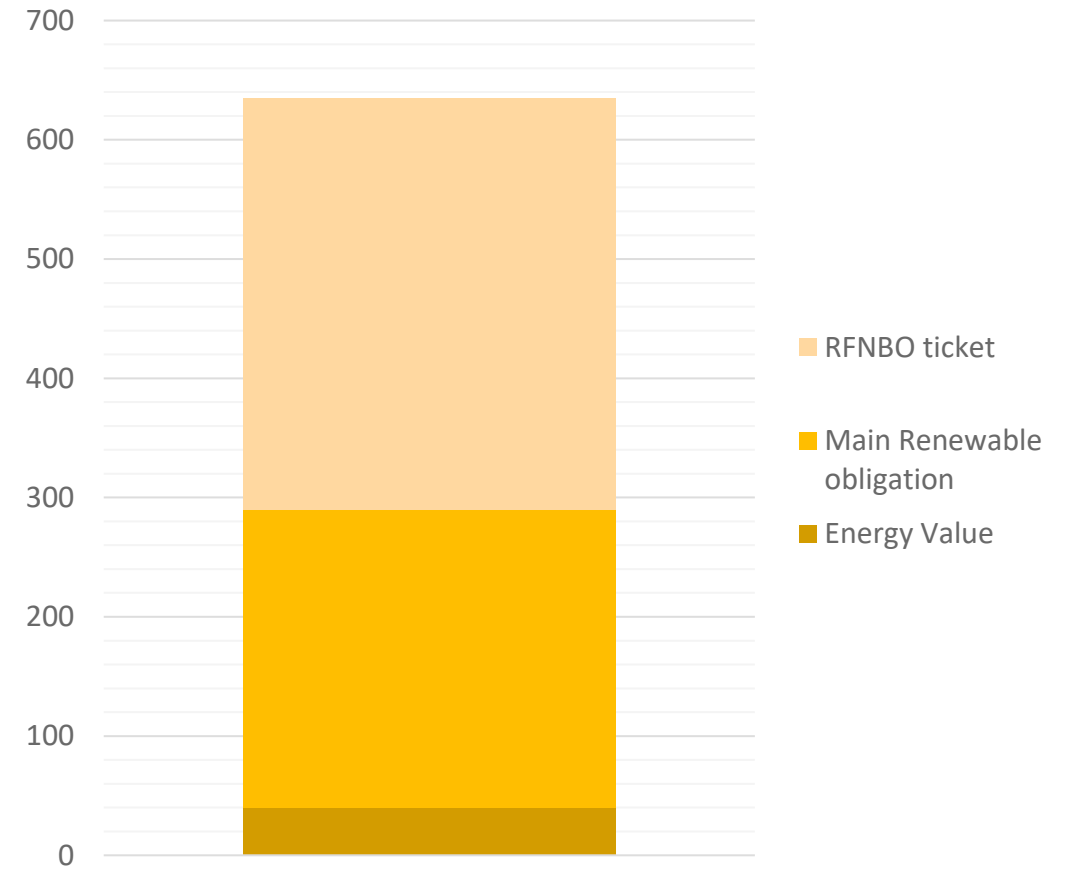
European regulation is rapidly creating a premium market for Renewable Fuels Of Non-Biological Origin (RFNBO).

Demand is:

- Legally mandated
- Backed by non-compliance penalties
- Structurally exceeding available supply

For biogas operators, this enables:

- Entry into premium fuel markets
- Long-term revenue stability
- Strong positioning in future energy systems



Data Source: Adapted from Case for Capturing RFNBO Value Now (2026), [Nordic RenGas]. Includes TTF energy price assumption (33.5 €/MWh) and estimated national RFNBO compliance values.
https://ren-gas.com/wp-content/uploads/2026/02/RenGas-Case-for-Capturing-RFNBO-Value-Now-v1_0.pdf

eMethane value formation
Value stack of methane from CO₂ utilisation (EU high-value case)

What this means for Biogas Plants



By integrating methanation, a biogas plant evolves from:

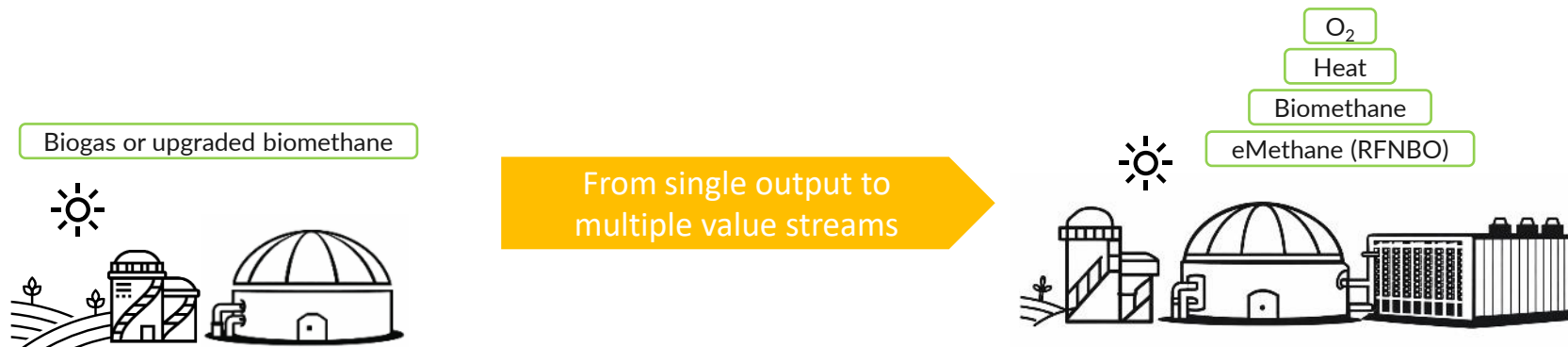
A biomethane production unit

→ into

A flexible renewable methane production system

This enables:

- CO₂ utilization instead of release
- Increased methane yield
- Multi-market operation (biomethane + RFNBO)



SECTION 2 — SOLUTION

*Q Power – Concrete Solutions for the fight
against climate change*



Power-to-X technologies with over 15 years of experience

Background

- Technology innovation research started already in 2007
- Privately own company. Main owners Ilkka Herlin & Saara Kankaanrinta

Core expertise: Own patented microbiological methanation

- Highly efficient and patented solid state reactor design
- First industrial scale plant delivered in Finland

Complete Power-to-X solutions, together with partnering technologies

- Hydrogen production, carbon capture and handling, gasifiers, gas processing, storage...
- Integrated and designed for Customer needs

Consulting services to help Customers' projects onwards

- Feasibility studies, piloting and gas testing services

Power-to-X technologies with over 15 years of experience

ST1 methanation of CO₂ side stream from **bio-ethanol** production
2019

Strategic **Power-to-Methane** cooperation begins with Kerava Energy
2021

First industrial-scale **eMethane** plant (3 MW) for P2X Solutions
Contract Awarded 2022
Commissioned 2026

2nd generation Methanation reactor design started. Aiming for wider capacity, more efficiency and less steel
2023

Synferm Synthesis gas methanation Pilot in Sweden
2024

EPC biochar and synthesis gas plant delivery to Qvidja Gård (biochar, heat, power and biomethane)
2025-2026

2007->
MTT, LUKE

Power-to-X test platform built at Qvidja. 2017 - 2018

Piloting, Commercializing

Industrial Scale

A successful pilot in which **low-quality landfill gas** was methanized in Salo
2020

The world's smallest methanation plant **Wärtsilä Dubai World Expo** Demonstration unit
2021

Waste-to-Energy pilot at **Fortum's** Riihimäki waste incineration plant.
2022

H₂ and CO₂ solutions. Commercialization, engineering and design.
2023 -2024

Turnkey CO₂ purification and compression unit delivered to CarbonReUse Finland
2025

Two Micro scale CO₂ Liquefaction units delivery: Purification, drying and liquefaction.
2026



Core Services

+ **Power to X deliveries based on own and partners' technology**

Turnkey deliveries including manufacturing, installation and commissioning

- Q Power Microbiological Methanation technology
- CO₂ recovery and treatment technologies, including liquefaction
- Hydrogen production technologies
- Post-treatment of methane to the desired purity

+ **Methanation solutions based on our own technology**

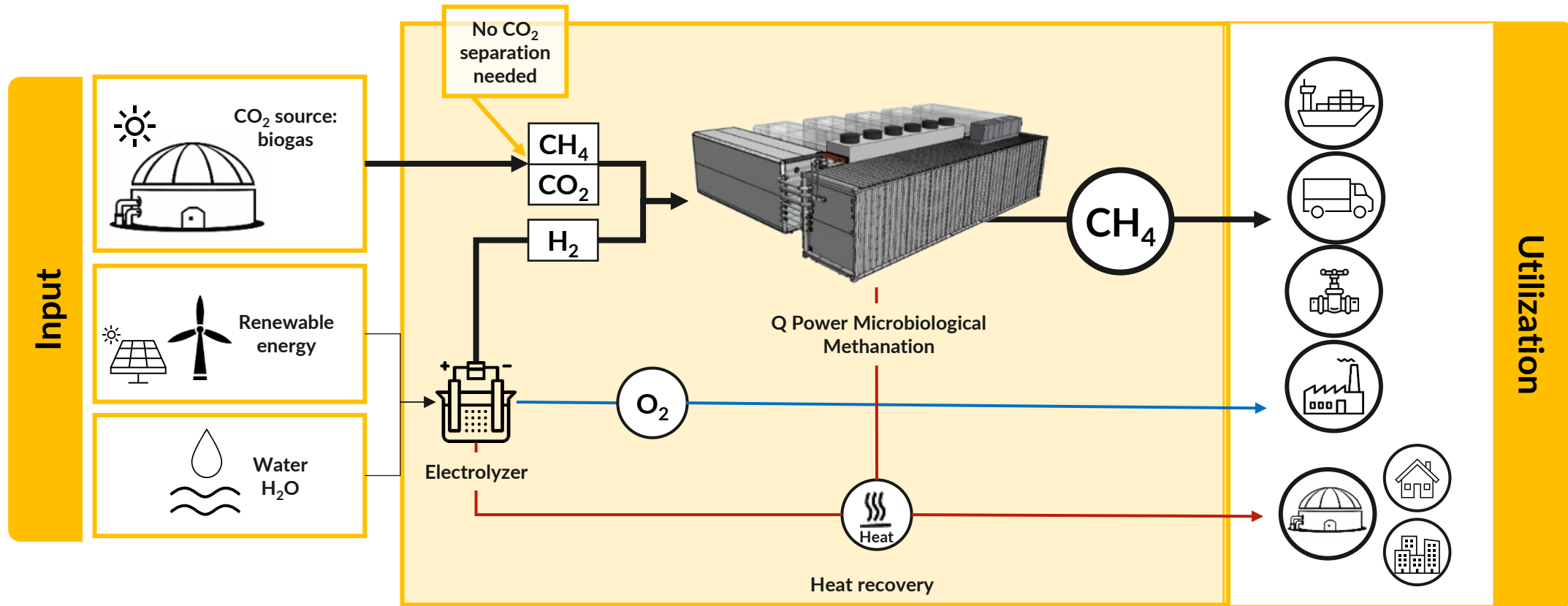
Turnkey deliveries including manufacturing, installation and commissioning

- Pretreatment of carbon dioxide as agreed
- Methanation technology
- Post-treatment of methane to the desired purity

+ **Expert services and pilot projects**

- Power to X consulting
- Preliminary studies and profitability calculations
- Specialist research services, prototyping etc.
- On-site Pilot services from customer feedstock to eMethane

Q Power-to-X with biogas



The integrated system produces multiple valuable output streams:

Methane (CH₄)

Biomethane and synthetic methane combined
Suitable for grid injection, transport fuel and industrial use

Oxygen (O₂)

By-product from electrolysis
Can be utilized in industrial or process applications

Low-temperature heat

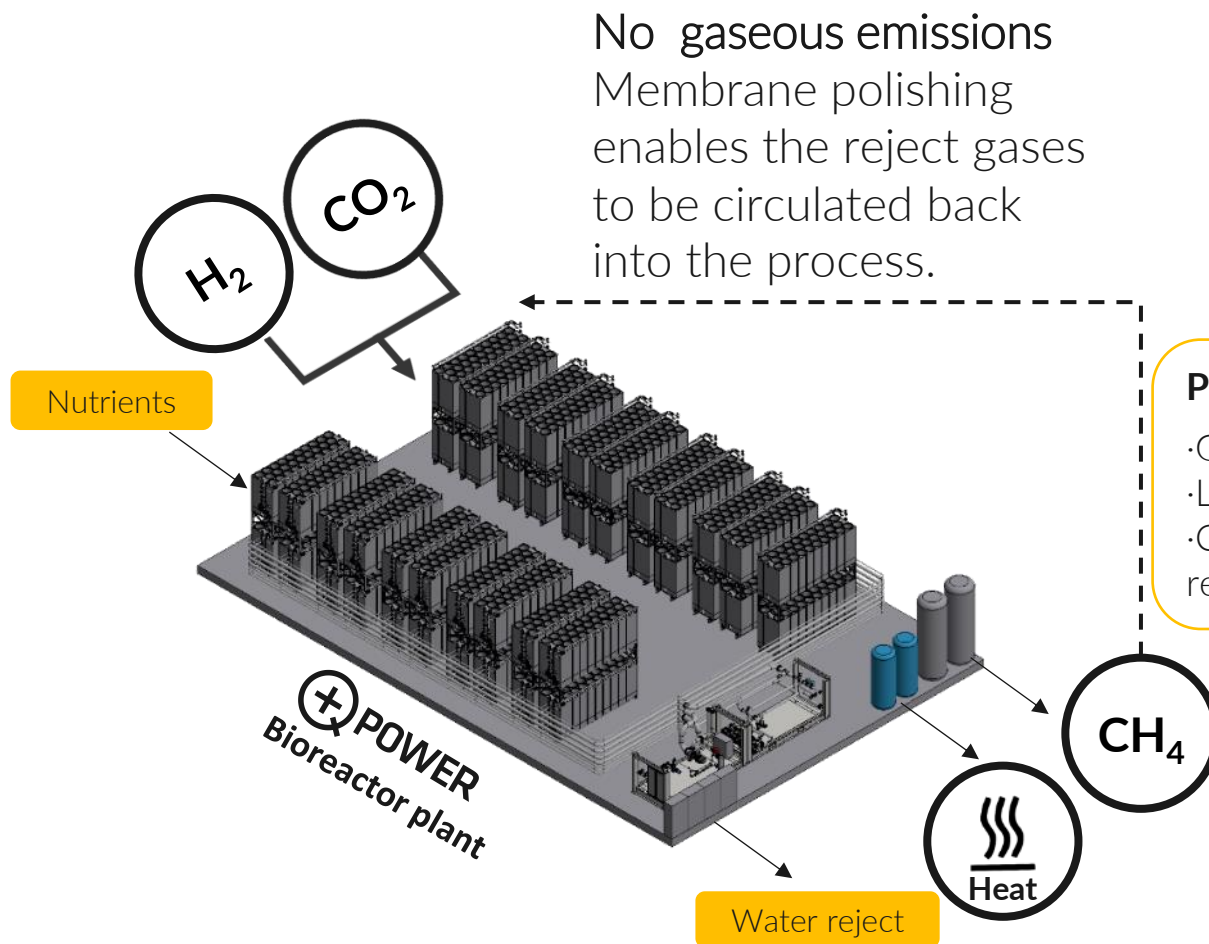
Generated from methanation and electrolysis
Can be recovered for internal use or external heating purposes

Q Power Microbiological Methanation

Solid State reactor technology

Supplies & connections

Grid connection 400V
Hydrogen supply
CO₂ supply
Cooling water supply
Auxiliary CO₂ supply
Nutrients supply
Compressed air supply



Product gas polishing options

- Grid quality (≥ 98 vol-% CH₄) @ 15 barG
- Liquefaction quality @ 15 barG
- Closed loop purification, no gaseous reject emissions.

SECTION 3 — INTEGRATION

*Standardized solutions with project-specific
integration*



Integration philosophy

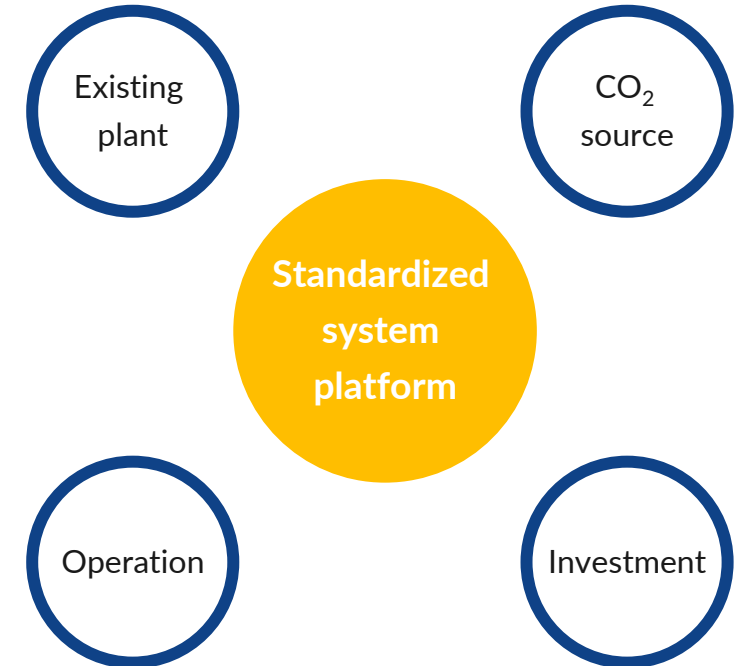
Q Power delivers methanation as a standardized system platform, adapted to each plant without requiring full custom engineering.

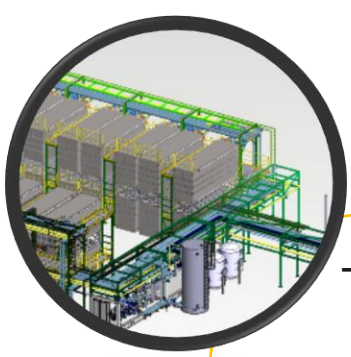
Integration is based on:

- Existing infrastructure (brownfield vs greenfield)
- CO₂ availability and utilization targets
- Operational flexibility requirements
- Investment scope

This ensures:

- Optimal use of existing assets
- No unnecessary duplication of equipment
- Future-proof operation across changing market conditions
- Optimized engineering overhead





Flexible integration using a standardized system

The same methanation system platform can be integrated into biogas plants in multiple ways:

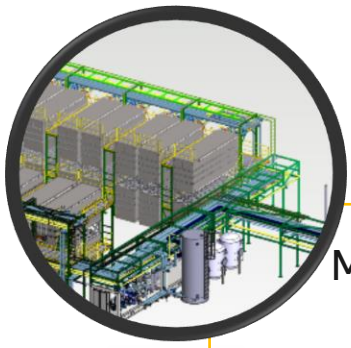
- 1. Fully integrated systems with flexible gas routing
- 2. Stand-alone methanation with independent polishing
- 3. Integration with existing upgrading unit (CO₂-based)
- 4. Integration with existing upgrading unit (raw biogas feed)

Each configuration is based on predefined system architectures, avoiding unnecessary engineering effort while enabling optimal plant integration.

Each approach represents a different balance between:

- CAPEX
- Integration effort
- Operational flexibility
- Utilization of existing assets





Integration Option 1 – Fully Integrated Q Power System

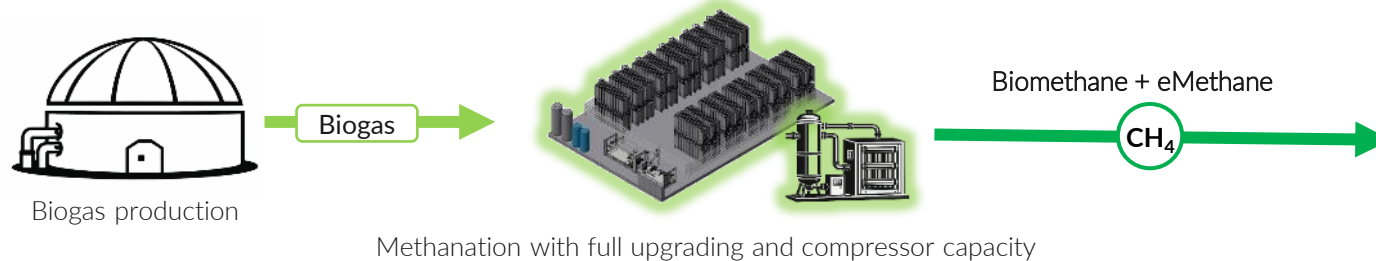
Methanation and upgrading are designed as an integrated system by Q Power with flexible gas routing.

Key characteristics:

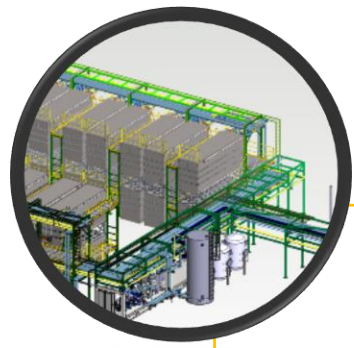
- Maximum operational flexibility
- No overlapping investments
- Ability to operate in multiple modes

Best suited for:

- New plants
- Major upgrades
- Projects targeting long-term optimization



System can operate in conventional upgrading mode when methanation is not utilized.



Integration Option 2– Stand-alone (Plug & Play)

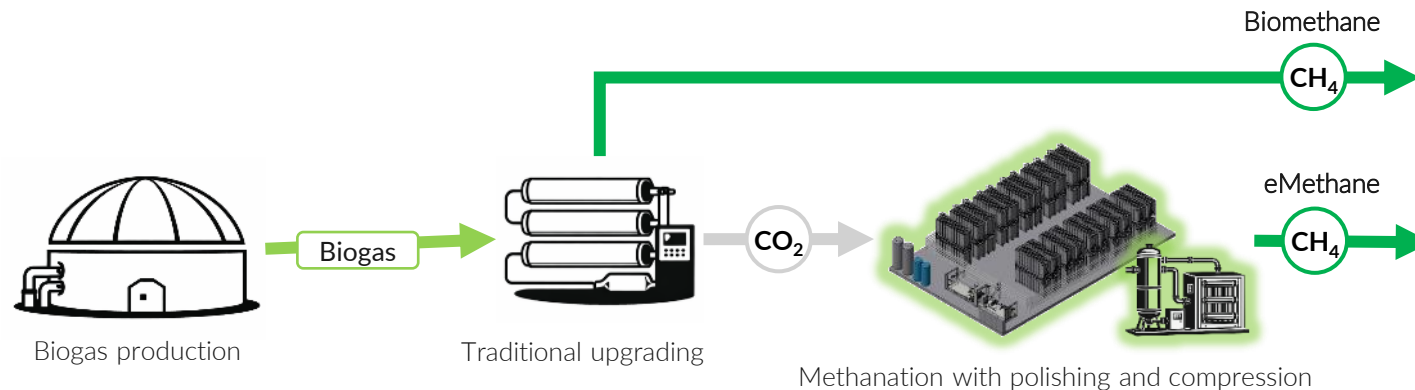
A fully independent methanation and polishing unit enables rapid integration with minimal modifications to the existing plant.

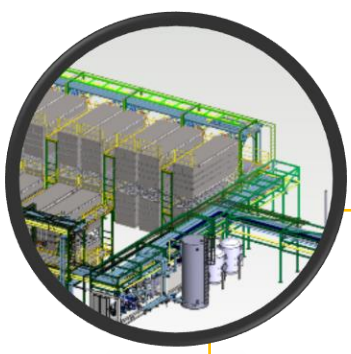
Key characteristics:

- Plug-and-play installation
- Fully independent operation
- Closed-loop polishing step for methanation

Best suited for:

- Existing plants with limited modification possibilities
- Projects prioritizing speed and simplicity





Integration Option 3 – Upstream with CO₂ Feed

Methanation utilizes CO₂ from the existing upgrading unit and returns synthetic methane to the process.

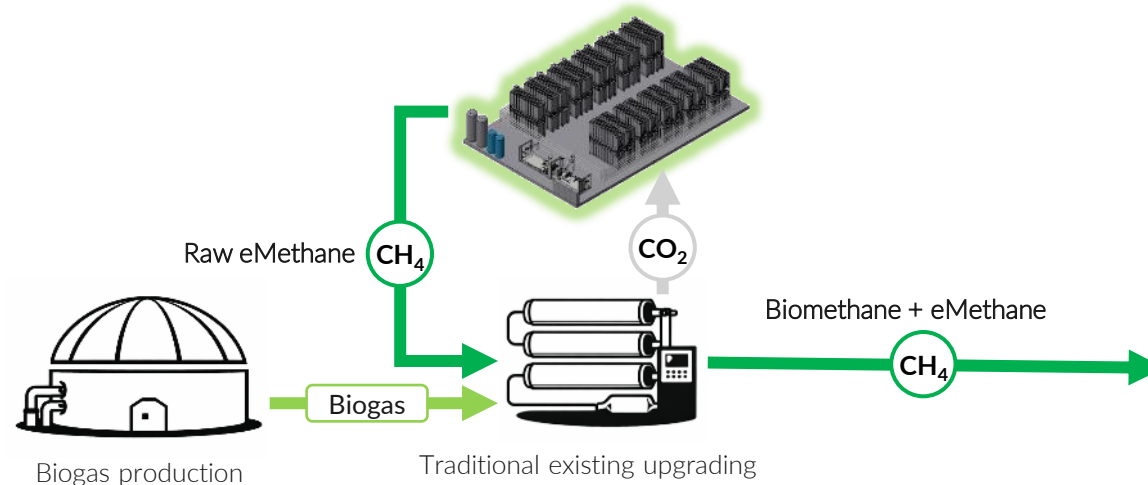
Key characteristics:

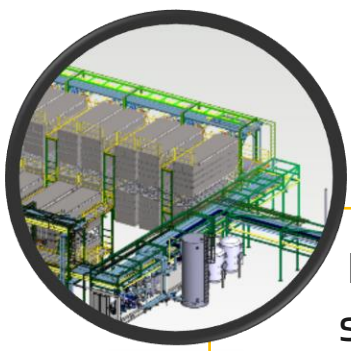
- Efficient utilization of existing upgrading infrastructure
- No duplication of upgrading equipment
- Increased throughput to upgrading unit depending on CO₂ utilization

Considerations:

- Integration with existing system required
- Capacity verification of upgrading unit

Methanation without polishing and compression





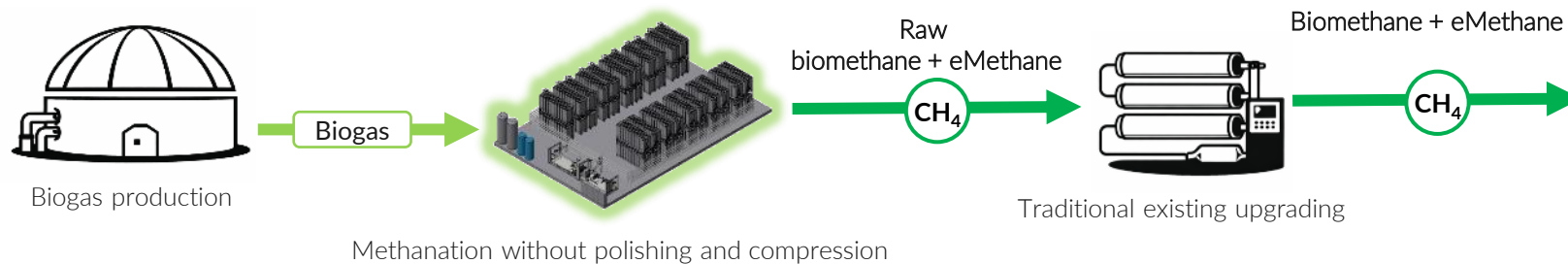
Integration Option 4 – Raw Biogas Integration

Raw biogas (all or part of) is directly converted in methanation and returned to the existing upgrading system.

Key characteristics:

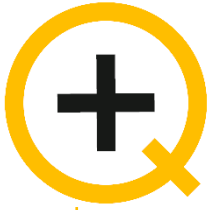
- No increase in upgrading unit capacity requirement
- Improved gas composition before upgrading
- Efficient use of existing plant infrastructure

Considerations: Process simulation / evaluation required for the existing upgrading equipment due to changing gas composition



System can operate in conventional upgrading mode when methanation is not utilized.

Operational Flexibility



The system can operate in multiple modes depending on market conditions:

- Methanation active → maximize methane output and CO₂ utilization
- Methanation reduced → partial optimization
- Methanation bypassed → standard biogas upgrading

This enables:

- Optimization against electricity price
- Optimization against RFNBO value
- Continuous plant operation in all scenarios

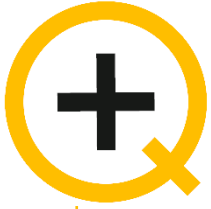


SECTION 4 — VALUE & DELIVERY

*Value creation through increased methane yield
and CO₂ utilization*

Value for plant operators

without heavy engineering



Q Power methanation solution brings **value** to both **brownfield** and **greenfield** biogas plant sites

Value for Existing Plants (Brownfield)

- Increased methane production without additional digestate feedstock
- Utilization of existing upgrading and infrastructure
- Stepwise investment approach
- Predictable and fast implementation = Minimal disruption to operations
- RFNBO-market ready fuel production

Value for New Plants (Greenfield)

- Optimized system design using proven configurations
- No duplication of equipment
- Reduced project complexity
- Maximum CO₂ utilization
- RFNBO-market ready fuel production from day one



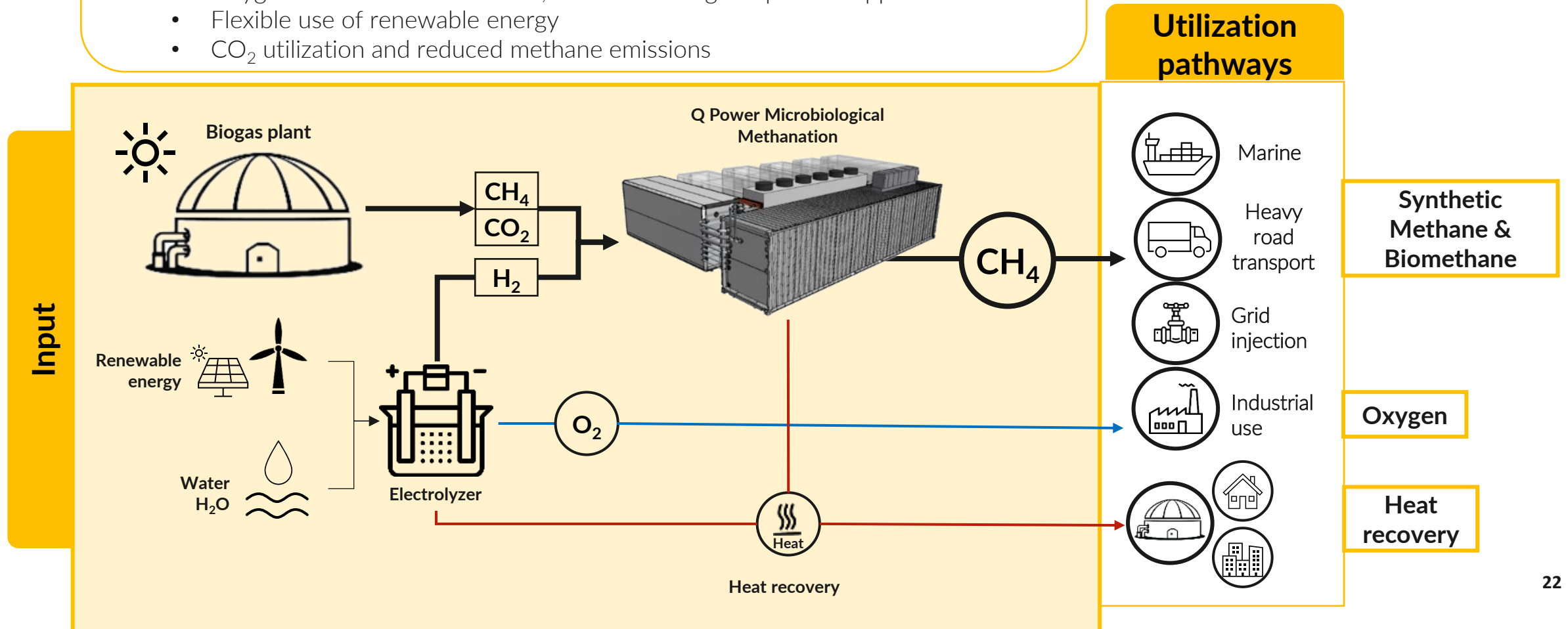
System Outputs



The integrated system produces multiple products which enable multiple utilization pathways.

Beyond methane production, the system enables:

- Heat recovery for internal or external use
- Oxygen utilization for industrial, food & beverage or process applications
- Flexible use of renewable energy
- CO₂ utilization and reduced methane emissions



Why Q Power

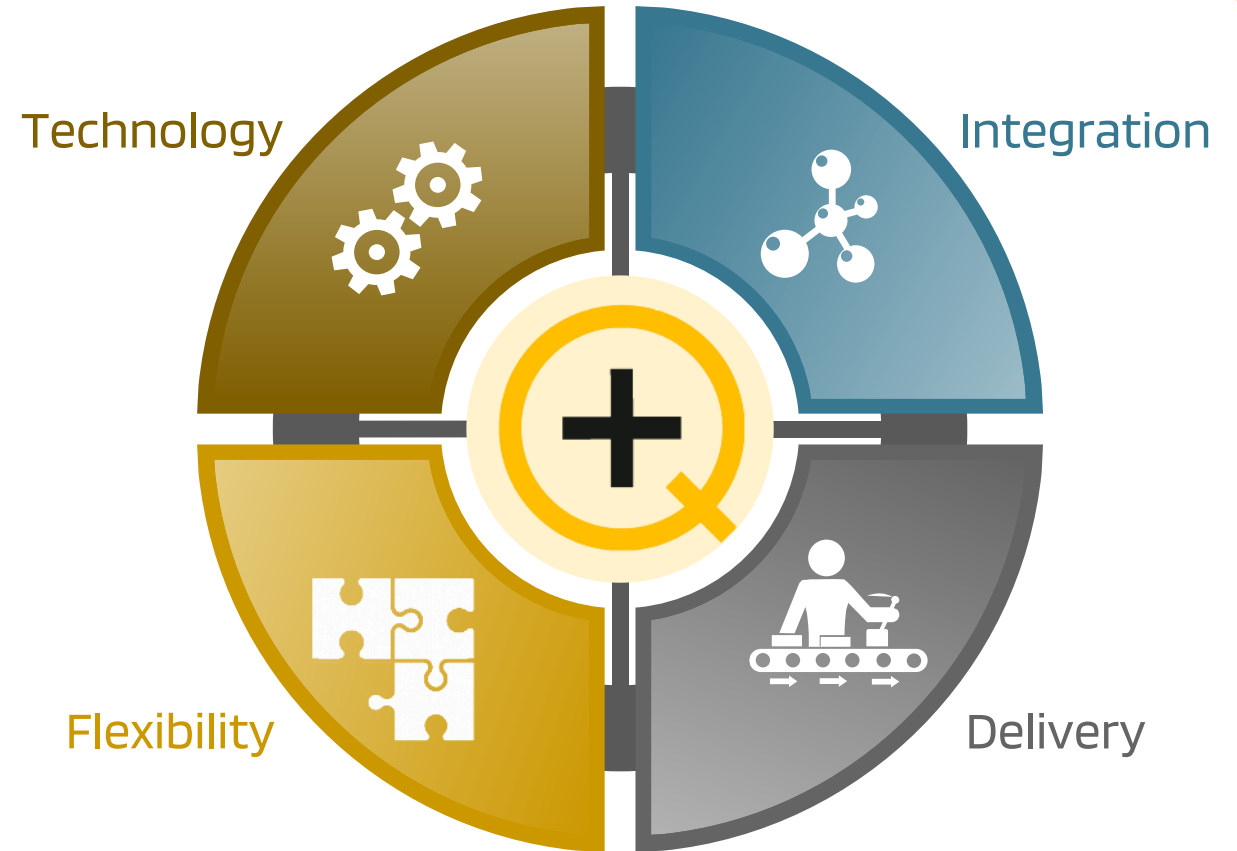


Q Power combines:

- Proven methanation technology
- Deep process and integration expertise
- Flexible system design approach
- Turn-key delivery capability

We deliver systems that are:

- Technically robust
- Commercially optimized
- Designed for real-world operation



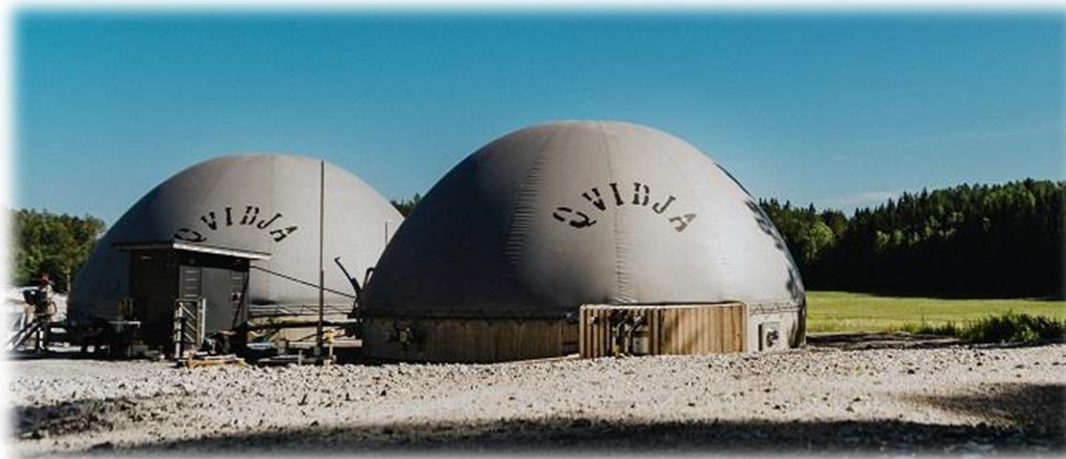
Summary



Methanation enables biogas plants to evolve into flexible renewable methane production system.

Key outcomes

- Increased methane yield without additional digestate feedstock
- CO₂ utilization through conversion to methane
- Access to premium fuel markets (RFNBO)
- Flexible and future-proof plant operation



Q Power provides

- Standardized system platform configured to each plant
- Integration without complex or resource-intensive engineering
- Proven methanation technology with real-world implementation
- Predictable, scalable turn-key delivery model





Concrete solutions for fighting climate change

Contact information

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