POWER-TO-GAS CONCEPT THROUGH BIOLOGICAL CO_2 HYDROGENATION PROCESS

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Aim

Electricity cannot be stored economically and must be consumed the same second it is produced.

Supply and demand must always be precisely balanced in the electricity grid, and overload must be avoided.

In cases of excess electricity supply, generating companies must pay the managers of the grid to take their electricity (negative prices).

Power-to-gas technologies can provide storage solutions for this excess energy.

Methodology

Biological hydrogenation of CO_2 into biomethane.

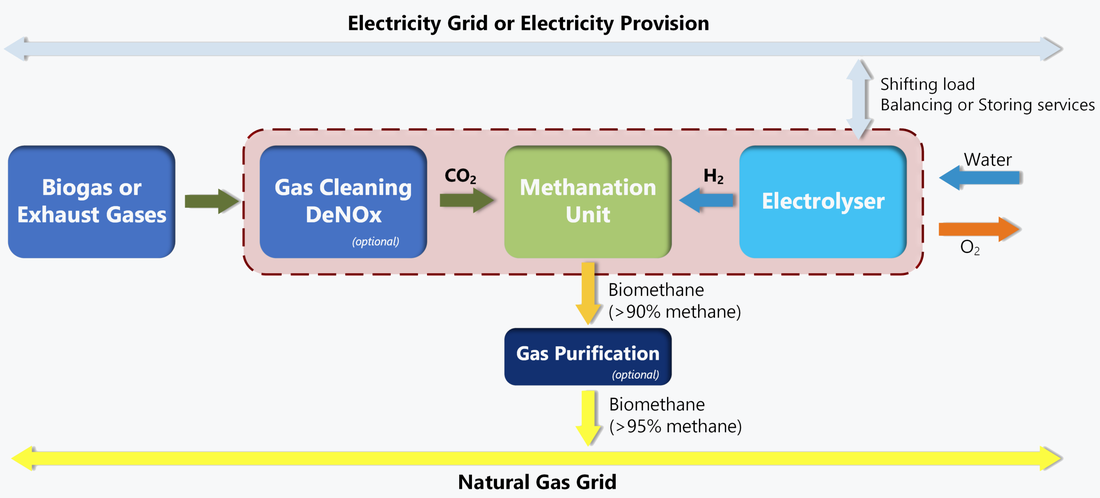
Mild temperature and ambient pressure | Low energy cost.

Various exogenous CO_2 sources, such as biogas (CO_2 content ~35-50%) or exhaust/flue gas (5-17% CO_2).

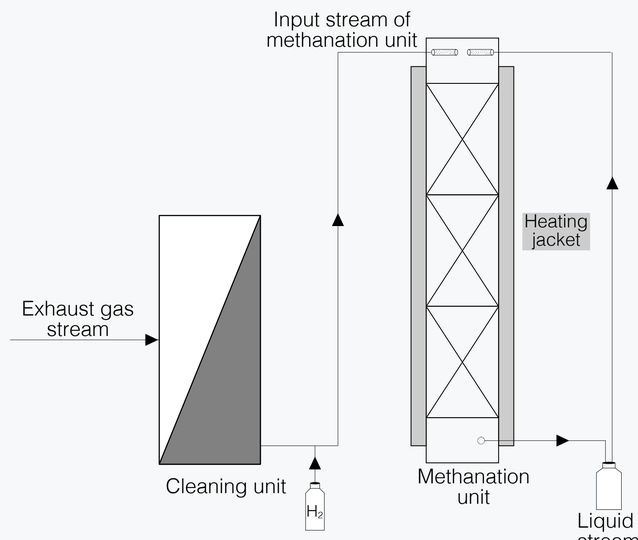
Exemplary method for seasonal on-site energy storage.

H_2 is coupled with carbon dioxide from power plants or CO_2-intensive industries

Concept



Pilot unit scheme



Gas Retention Time (h)	CO_2 capture (kg CO_2/m³ reactor)
12	0.65
6	1.30
3	2.59
2	3.89
1	7.78
0.5	15.56

The methane produced is 95% pure and directly compatible with CNG, feeding into an expanding transport fuel market.

Innovation

Biomethanisation is carried out by naturally occurring mixed cultures of hydrogenotrophic methanogens, which can be adapted to work with non-refined sources of CO_2.

The CH_4 produced can be directly injected into the gas grid (after only minimal cleaning), allowing distribution and use for power generation and direct heat applications.

Surplus off-peak electricity can be exploited for electrolytically-produced hydrogen

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