Injection of biomethane: international comparison on gas quality specifications, data recorded and injection plant designs

Common goals to decarbonize

SoCalGas:

- renewable natural gas (RNG) as a key tool in helping to **decarbonize** the gas system
- aim to have **net-zero greenhouse gas emissions** by 2045 in both its operations and delivery of gas
- goal of delivering **20% biomethane** to core customers by 2030

Énergir:

- **7 producers** injecting RNG into the network
- target at 5% of the total volumes delivered to customers in 2026 and **10% in 2031**

GRTgaz/GRDF:

- **650 locations** injecting RNG in 2023
- renewable natural gas could account for **20% of all gas consumed** in France by 2030

RNG injection plant

The design of the **injection stations are similar** in all three jurisdictions: analysis the quality of the gas, regulate the pressure, odorize the gas and control the operation of the stations.

In France:
more than 10 years of biomethane injection into the different gas systems allowed the French operators to refine their design and have **one type of station for distribution and one for transmission,** which meets the needs of the producers.

In California:
injection **stations are specific to each project**. Although the general concept and functions remain the same from one injection station to the other, each injection station has its own particularities based on the type of feedstock(s), biogas composition, minimum and maximum expected volume, delivery pressure, and physical layout considerations.

In Quebec:
there are **2 different types of injection stations**, and the choice of station will rest on the type of project. Due to the cold winter weather conditions in Quebec, station design includes certain elements to make sure that the station will work properly under extreme conditions.

RNG Quality Management

Table 1 - Technical specifications for continuously monitored constituents

Parameters	France	California	Quebec
High Calorific Value (reference conditions 0 °C and 1.01325 bar)	H Gas: 10.7 to 12.8 kWh/Sm^3	36.1 to 42.8 MJ/m^3 (10 to 11.9 KWh/Sm^3)	≥ 36 MJ/m^3 (10.5 kWh/Sm^3)
	L Gas : 9.5 to 10.5 kWh/Sm^3	—	—
Wobbe Index (reference conditions 0 °C and 1.01325 bar)	H Gas: 13.64 to 15.70 kWh/Sm^3	47.6 to 51 MJ/m^3 (13.2 to 14.1 kWh/Sm^3)	≥ 47.23 MJ/m^3 (13.8 kWh/Sm^3)
	L Gas: 12.01 to 13.06 kWh/Sm^3	—	—
Density	Between 0.555 and 0.70	—	0.554 to 0.583 for biomethane
Water Dew Point	Less -5 °C at the maximum pressure of the network downstream	≤ 112 mg/m^3 ≤ -6.7 °C at P (for P > 55 bar_g)	≤ 35 mg/m^3
Hydrocarbon Dew Point	Less -2 °C from 1 to 70 bar	≤ 7.2 °C at 27 bar_g or at P < 27 bar_g ≤ -6.7 °C at 27 bar_g for P > 55 bar_g	Less than -10 °C at 5,500 kPa
Total sulfur	Less 30 mg(S)/Sm^3	≤ 17 mg(S)/m^3	≤ 115 mg/m^3
Total mercaptan	Less 6 mg(S)/Sm^3	≤ 7 mg(S)/m^3	—
Total concentration of H_2S and COS	Less 5 mg(S)/Sm^3	≤ 6 mg/m^3 (H_2S)	≤ 7 mg/m^3 (H_2S)
Carbon dioxide - CO_2	Less than 2.5%	≤ 3%	Less than 2%
Gas odorant	THT: 15 to 40 mg/Sm^3	—	—
Oxygen - O_2	Less than 100 ppm	≤ 0.2%	Less than 0.4%
Total inerts (CO_2 + O_2 + N_2 etc.), vol. %	—	≤ 4%	Less than 4%

Note: reference conditions are different for each utility
France: reference conditions of 0 °C at 1.01325 bar
California: reference conditions of 15.6 °C at 1.01565 bar
Quebec: reference conditions of 15 °C at 1.01325 bar

Table 2 - Technical specifications for periodically sampled constituents

Compounds	France	California	Quebec
Mercury Hg	Less than 1 mg/Sm^3	0.08 mg/m^3	≤ 0.01 mg/m^3
Cl	Less than 1 mg/Sm^3	*50 mg/m^3	≤ 10 mg/m^3
F	Less than 10 mg/Sm^3	*75 mg/m^3	≤ 10 mg/m^3
H_2	Less than 6%	≤ 1%	Not specified, but not prohibited
NH_3	Less than 3 mg/Sm^3	≤ 7 mg/m^3	≤ 7.2 mg/m^3
CO	Less than 2%	*0.03%	—
As	—	≤ 0.19 mg/m^3	≤ 0.60 mg/m^3
Cu	—	≤ 0.6 mg/m^3	≤ 0.19 mg/m^3
p-dichlorobenzenes	—	57 mg/m^3	—
ethylbenzene	—	260 mg/m^3	—
n-nitroso-di-n-propylamine	—	0.33 mg/m^3	—
vinyl chloride	—	8.4 mg/m^3	—
lead	—	0.75 mg/m^3	—
methacrolein	—	11 mg/m^3	—
toluene	—	9,000 mg/m^3	—
Total Si	—	≤ 0.1 mg/m^3	≤ 0.5 mg/m^3

* California's Lower Action Level (LAL) - proposed figures pending CPUC approval.

- Similar values for the **caloric value** and the **Wobbe Index**.
- Main differences are for oxygen, even if in France some deviations can be accepted under specific conditions, for instance up to 0.7% if no sensitive customers are connected to the grid. **In France no restriction** has been put on the total of inerts, as opposed to **Quebec and California, which have limited** those to a **maximum of 4%**.

Conclusion

- In both Europe and North America, the **injection facility** linking biomethane production to the network is designed with the same functions: to **monitor gas quality, prevent non-compliant biomethane** from entering the gas network, and **meter and odorize** the biomethane.
- California, Quebec and France **measure the same main non-methane components** (CO_2, O_2, N_2, H_2S, H_2O) and have similar references for the caloric value and the Wobbe Index, even though **some differences exist** on thresholds and the monitoring of other minor components.
- Further research is needed to **optimize the injection facility** design, operation and maintenance, and **harmonize gas quality specifications** in order to standardize the different components.
- This would result in **possible cost reductions** while preserving the **gas network integrity** and ensuring **safe and proper combustion** in end-user equipment.

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