AUTOMETH

METHANATION TECHNOLOGY FOR SUSTAINABLE BIOGAS UTILIZATION

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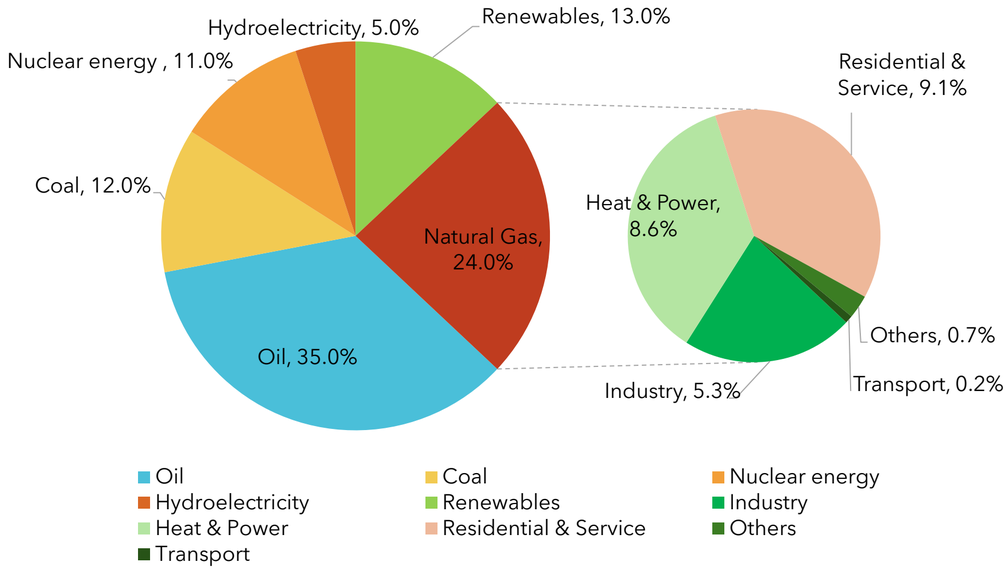
INTRODUCTION

Natural gas accounts for 20-25 % of Europe´s primary energy, vital for industrial activities and applications hard to electrify in short or medium term (Fig.1). The shift to sustainable energy sources promotes efforts to replace natural gas with renewable options. Expanding biogas and biomethane is a key strategy. Combining biogas with green hydrogen through **methanation** is an innovative approach to convert the biogas-CO_2 in **renewable methane** (Fig. 2). This methane, with properties identical to fossil methane, can be used in existing infrastructures and supports both domestic residential and industrial decarbonization.



Total primary energy consumption: 1316 Mtoe

Fig. 1. Primary energy consumption by fuel and Natural Gas use in European Union in 2021

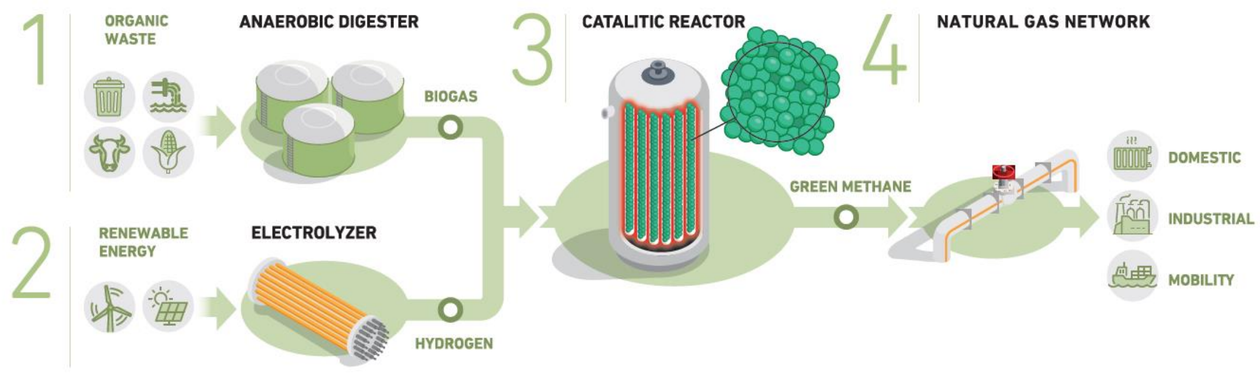


Fig. 2. Methanation process scheme

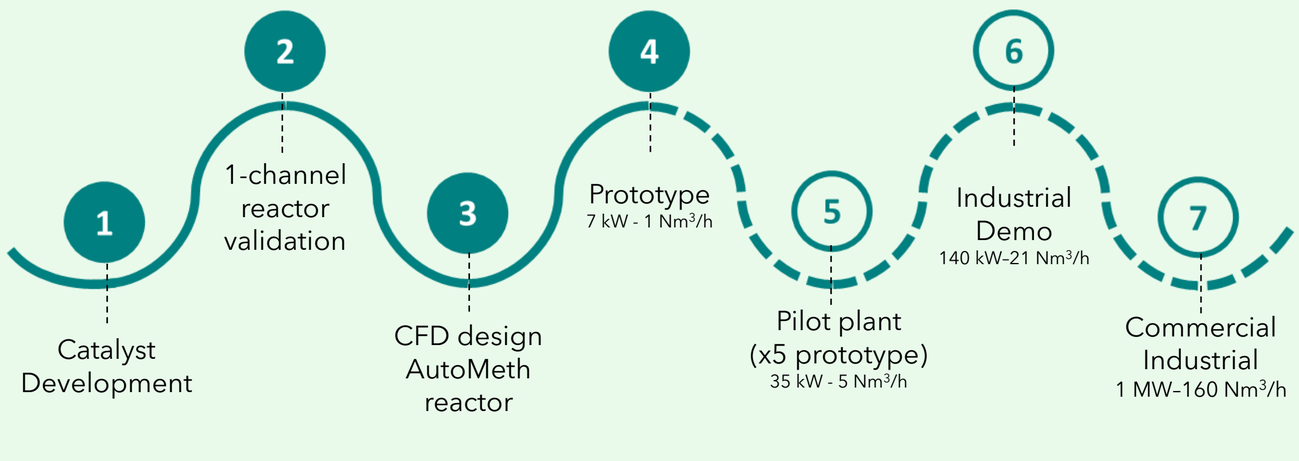


Fig. 3. Catalyst production at IREC labs.

Fig. 4. Prototype installation in the landfill of Mas de Barberans, in Spain.

AUTOMETH REACTOR

The ambitious aims of the project were to design and develop a novel reactor capable of overcoming the limitations of existing methanation technology designs by minimizing both investment and operational costs, while ensuring a high quality of the final product.

The development process included:

- Design and development of a proprietary catalyst to increase the efficiency of the methanation reaction (Fig.3).
- Design, construction and testing of an initial first design of reactor (single channel).
- CFD simulations led to the final multi-channel AutoMeth reactor design. It has reduced heat exchange equipment, operates at moderate working pressure, and supports auto-thermal operation.
- A AutoMeth prototype of 1 Nm^3/h was built and tested in the landfill of Mas De Barberans, in Terres de l'Ebre (Fig.4)

The goal is now to scale up the development to a pilot plant with a capacity of 35 kW, followed by an industrial demonstration and, eventually, the launch of a commercial product.

PROTOTYPE RESULTS on site

- The desired **gas composition** (Table 1) was obtained at 100 % of the capacity, at P = 6.5 bar and in 10-15 minutes.
- Start-up in less than 1 hour
- **Stable** operation for 150-200 hours, working continuously over 24-hour periods (Fig. 5)
- **Robust** functioning, with no alterations by changes in biogas composition, or external factors as ambient temperature or operational issues (Fig. 5).

Component	CH_4	CO_2	H_2
Legislation (%)	> 90	< 2.5	< 5
Experimental (%)	93.68	2.02	4.30

Table 1. Outlet gas composition vs legislation values

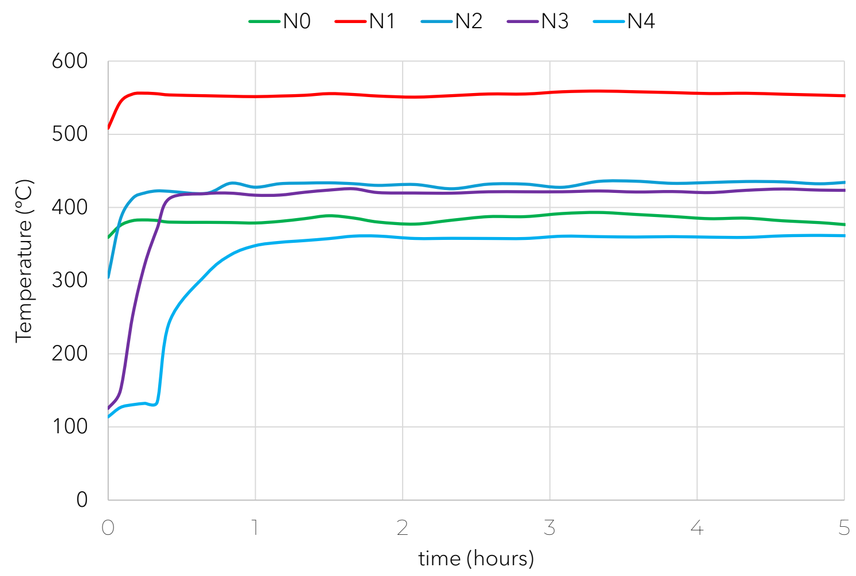


Fig. 5. Temperature profile in the reactor during the on-site validation

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