

# EN ROUTE TO A SUSTAINABLE METHANOL-BASED ECONOMY BY HYDROGENATION OF CO<sub>2</sub>



## Introduction

Due to the rising levels of CO<sub>2</sub> in the atmosphere, one of the most important questions of environmental chemistry is the conversion of CO<sub>2</sub> into useful chemicals, such as fuels.

Catalytic hydrogenation of carbon-dioxide into methanol using various metal-oxide catalysts is one of the most popular and most researched methods to achieve this.

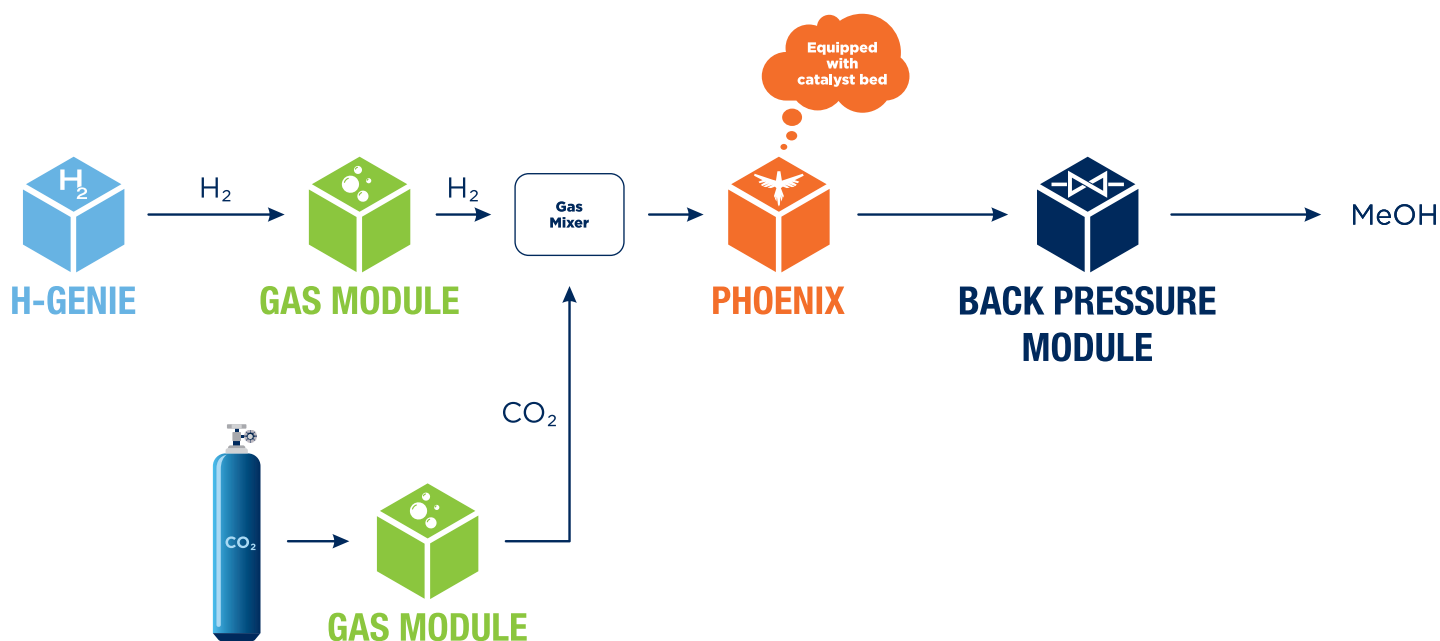
Using ThalesNano's Phoenix™ and H-Genie® system, this process can be optimized and performed safely while also offering easy scale-up options.

This flow reactor system operates under a wide range of parameters, achieving temperatures up to 450 °C, pressures up to 100 bar, and hydrogen flow rate of up to 1 NL/min.



**Main features:**

- Safety:** hydrogen is produced on demand, cylinders of H<sub>2</sub> are not required.
- High selectivity:** 70% methanol selectivity was achieved using CO<sub>2</sub>:H<sub>2</sub>=1:4 mixture (100mL/min combined flow rate) and CuO/ZnO/Al<sub>2</sub>O<sub>3</sub> as catalyst at 300 °C and 30 bar.
- Flexibility:** conditions (flow rate, temperature and pressure) can be adjusted rapidly even during production allowing quick optimization.
- Simplicity:** the reactor system is easy to handle, operate and modify.
- Scalability:** The Phoenix flow reactor can be equipped with appropriately sized catalyst beds (CatCarts®, MidiCarts® or larger MMS cartridges), therefore the system is suitable for both small- and large-scale productions.



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