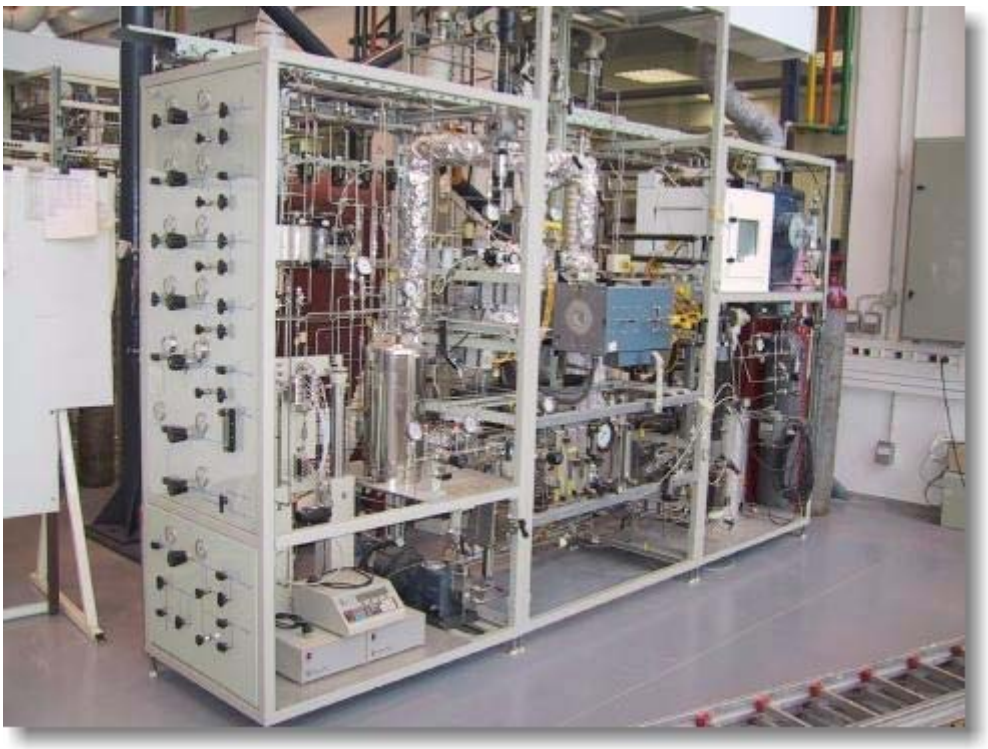
SYN-GAS PILOT PLANT

A spouted bed reactor pilot plant exists in CPERI using a high degree of automation. The pilot plant is used for catalytic partial oxidation of Methane to hydrocarbons and synthesis gas.



Spouted bed is a promising reactor configuration in oxidative partial oxidation process, because it combines short residence times for the gas phase along with almost perfect mixing of the solid particles, which enhances the heat transfer inside the bed. The pilot plant is constructed in modules, and can be divided into the following discrete sections:

The feed module: This section consists of 8 independent gas feed lines and one liquid feed line with all the necessary safety and automation equipment, supplying the following gases: Methane (or natural gas), Nitrogen (or Helium), Carbon Dioxide, Hydrogen, Oxygen and Nitrogen. The feed lines of the first four substances are mixed together prior to feeding into the reactor. Liquid water is delivered at the system pressure from a liquid feed vessel by a precise syringe pump. Water is converted into steam, after passing through a steaming unit before entering into the process.

The spouted bed reactor: The specifications of the reactor are reported below:

Internal Diameter, mm	54
Solids Catalyst Load, gr	70-200
Maximum Gas Flow, Slpm	45
Quench Steam Feed Rate, gr/min	3-5
Maximum Reactor Temperature, C	1100
Maximum Reactor Pressure, BARG	25
Residence time, sec	<0.5

The product delivery and analysis module: The reactor effluent is cooled down to 3-7 (C, passing through a heat exchanger). The liquid product (water) is recovered at the bottom of a cooled condenser-separator at 2 C, and it is collected into a liquid product vessel, while the total gas flow-out is recorded by means of a wet test meter with a digital interface, while a sub-stream is led to the analysis system, for on-line determination of the obtained composition of the gas products.