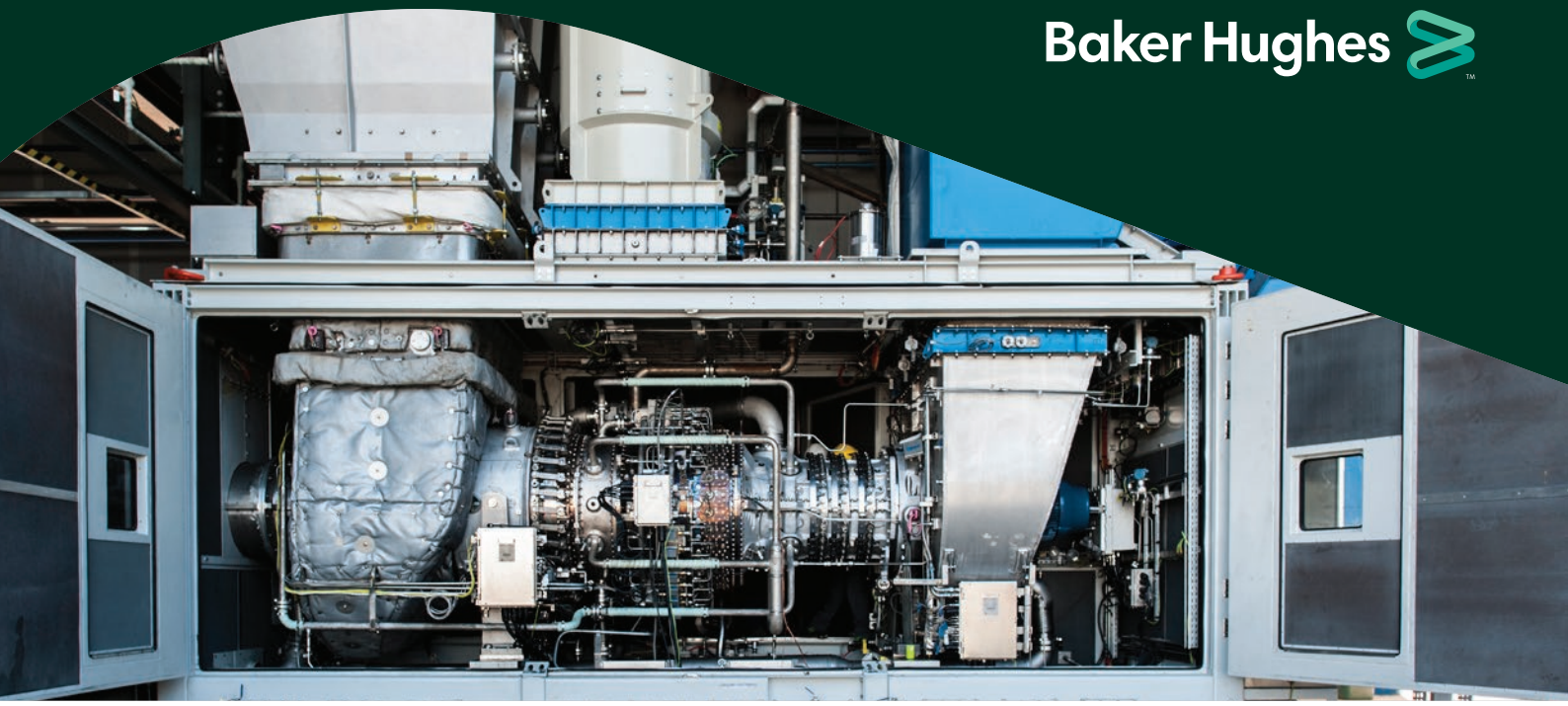
Baker Hughes



Case study

World's first hydrogen-blend turbine tested for gas pipeline infrastructure

In July 2020, the European Commission launched a Hydrogen Strategy in support of Europe achieving climate neutrality by 2050. It established intermediate goals for the production of renewable hydrogen, including production of at least 40 GW of hydrogen from renewables by 2030 and, large-scale deployment of hydrogen across all hard-to-decarbonize sectors by 2050.

Challenge

The European Commission's new Hydrogen Strategy requires scale-up of available technologies and cost reduction along the value chain, including high-pressure hydrogen transport. Snam, one of Europe's largest gas transmission and storage operators, asked Baker Hughes to help it adopt hydrogen blended with natural gas into its existing transmission infrastructure.

Solution

We have extensive experience in the design and manufacture of gas turbines and compressors for the pipeline industry. We also have unique experience with hydrogen-fueled gas turbines, with almost 70 units installed and operating worldwide.

In July 2020, Baker Hughes and Snam successfully completed testing of the world's first "hybrid" hydrogen turbine at our facility in Florence, Italy—the first time a gas infrastructure operator has tested this type of turbine for its existing assets.

The NovaLT™12 will be installed in 2021 at Snam's compressor station in Istrana, Italy. Once installed, the turbine will not only help move hydrogen fuel blends through Snam's pipeline network, but it will also run on those same blends.

Baker Hughes NovaLT™12 turbine at test bench in Florence, Italy, during hydrogen testing for Snam's Istrana project

NovaLT™ gas turbine family

The Baker Hughes NovaLT™ turbine family comprises the industry's first high-performance gas turbines inherently designed for hydrogen as well as other lower-carbon fuels. The turbines can burn methane and hydrogen blends from as little as 5% to as much as 100% hydrogen.

Developed using advanced computational methods and manufacturing technologies such as additive, the NovaLT™ turbines are suitable for a variety of applications, including pipeline, industrial power generation, and onshore/offshore production. Compared to other technologies in their various classes, each NovaLT™ provides lower consumption, wider operational flexibility, lower maintenance intervals, and emissions as low as single digit ppm NOx.

R&D tools and facilities supporting Fuel Flexibility

As the energy transition increasingly calls for new technology, Baker Hughes has the dedicated research resources and close partnerships with companies like Snam that enable innovative solutions capable of burning up to 100% hydrogen with low to zero emissions. In particular, Baker Hughes has developed and is continually improving its fuel flexibility capability thanks to advanced engineering tools and a wide number of test facilities, such as:

- **Virtual Lab tests (CFD)** for thermo fluid-dynamics, dynamics and thermo-acoustic assessments
- **Additive Manufacturing and Material Lab tests** covering the prototyping and industrialization of gas turbines components, including integrally printed burners
- **Combustion test facilities:**
  - SingleCup atmospheric and pressurized testing, either performed in house or through well-known Italian universities
  - Full-scale annular rig and multican rig tests, thanks to Sesta Lab (COSVIG, Italy)
  - Full engine testing, performed in-house

Benefits

By blending 10% hydrogen into its total annual gas transport capacity, Snam could handle estimated seven billion cubic meters of hydrogen—equivalent to the annual gas consumption of three million families, and a five-million-ton reduction in CO_2 emissions per year.

Snam's NovaLT™12 test results	
H_2 content	Up to 10%
Gas turbine load	50 to 100%
Max. power output (shaft, no losses)	~13 MW
Max. efficiency (shaft, no losses)	>37%
NOx emissions	≤15 ppmvd (15% O_2)

Baker Hughes