The use of hydrogen in internal combustion engines can reduce pollutant and CO2 emissions to nearly zero, but it requires new technologies for fuel supply and combustion control. The project develops a 20 kW two-stroke hydrogen engine for industrial uses, with efficiency and emissions similar to a fuel cell, but at a lower cost and capable of using other eco-sustainable fuels.

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Innovative Hydrogen Engine

GOALS

The project aims to demonstrate, with an experimental prototype, the potential of the two-stroke opposed-piston engine powered by hydrogen. Initially intended for 20 kW industrial engines, the concept can be extended to higher power levels and applied in various fields, including automotive.

RESULTS

The first result aims to develop a virtual model of the engine (digital twin), optimizing geometric and functional parameters through accurate thermo-fluid dynamic and structural analyses. Subsequently, the construction drawings of the various components will be created, which are essential for building the prototype. The prototype will finally be experimentally characterized by measuring performance and pollutant emissions.

ACTIVITY PLAN

The first activity involves the detailed definition of the engine's characteristics and design constraints, based on previous experience and preliminary calculations. Once the most promising configuration is identified, **we will build 1D and 3D CFD simulation models to optimize the main geometric and functional parameters of the engine**.

We will use advanced CAE tools for precise analysis of charge exchange and combustion processes, and to predict performance and pollutant emissions.

Upon completion of the **"digital twin"** optimization phase, we will proceed with the construction of a 3D CAD model of the entire engine and the detailed design of the prototype components.

Subsequently, we will physically create the prototype, proceed with assembly, and install it at the CNR-STEMS engine test facility. Finally, we will conduct experimental tests to **calibrate and measure the engine's performance and emissions**, demonstrating the potential of this innovative technology to reduce environmental impact in industrial sectors and beyond.