TITLE **Internal combustion engine with no harmful gas (NOx) or CO2 emissions**

DESCRIPTION OF THE TECHNOLOGY

An internal combustion engine, with high specific power and high efficiency, which uses two Brayton cycles: a first cycle that incorporates an MIEC membrane to separate O2 from the air so that the suctioned oxidizing stream has not any N2; a second cycle combined in a binary way with the first cycle and nested with a cycle selected from an Otto cycle and a Diesel cycle using oxy-combustion.

The first cycle delivers compressed O2 from the MIEC membrane to the second cycle. The second cycle transmits mechanical and thermal energy from the exhaust gases to the first cycle.

This technological integration prevents the emission of harmful gases (NOx) to the atmosphere by separating N2 in the MIEC membrane. It can be used in various ways, including but not limited to by way examples:

- Premixed or diffusion oxy combustion engine, with:
  - Either Zero (or low positive) tail pipe CO2 emissions.
  - or Negative tail pipe CO2 emissions: with a polymeric membrane or a molten carbonate-based membrane to separate CO2 from the air.

The technological proposal is presented with: the modeled and calculated solution, prototypes of the components (TRL4), and proposals for projects to obtain a prototype in a real environment (TRL7) within around two years, or less, depending on the amount of public and / or private financing raised.

MARKET APPLICATION SECTORS

Natural targets for the proposed technologies are:

- Manufacturers of engines and their components (own or external). Engines for manufacturers of vehicles for transporting passengers and goods by land and sea and for aviation up to a certain power level.
- Retrofitting current diesel engines.
- Oil companies, as prescribers, as they would be able to reclassify their products as non-polluting for use with these engines.
- Processes in which local O2 generation and oxy-combustion mean that CO2 can be liquefied without generating emissions.
- Circular economy projects for CO2.
- Processes requiring the compression of H2, O2, CO2 gases.

TECHNICAL ADVANTAGES AND BUSINESS BENEFITS

- Compliance, in the short term, with European emissions regulations planned for 2040.
- Engine efficiency means running costs are equivalent to current costs for users.
- Liquefied CO2 can be used to generate electrofuel by combining it with hydrogen from the electrolysis process assisted by renewable energy sources. Therefore, being a fundamental break in CO2 circular economy capturing it w/o tail pipe emission to the atmosphere.

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CURRENT STATE OF DEVELOPMENT

The technology has been validated in laboratory experiments: the air separation MIECs, some turbomachines and the MCIA have been validated separately, as well as their integration through the VEMOD software.

INTELLECTUAL PROPERTY RIGHTS

Patent Pending/Granted
Priority Number (SPTO): P201930285
Priority Date: 28/03/2019
PCT: PCT/ES2020/070199 (España (ES))
PCT Date: 21/03/2020

COLABORATION SOUGHT

An operational prototype of the system has been developed, tested, and validated in the laboratory. Seeking partners for further testing to evaluate/improve its performance in real-world scenarios, as well as companies interested in establishing patent license agreements for its use, manufacture or sale. The Technology Readiness Level can be considered to be TRL4.

RELATED IMAGES

Image 1:

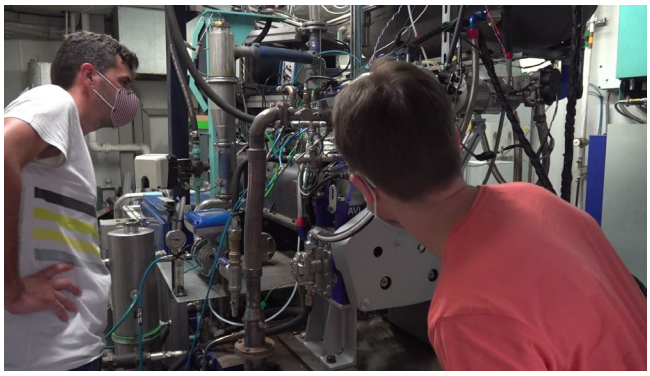

Image 2:

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