High hydrogen gas turbine retrofit to eliminate carbon emissions

Publieke samenvatting / Public summary

Aanleiding

Flexibility is key to supporting future energy generation. The growth in renewable solar and wind energy has emphasized the need for flexibility. Flexibility to reliably balance the load on the energy grid with the ability to rapidly adjust output while using cost effective fuels which also minimize carbon output. Gas turbines with a retrofit for hydrogen operation offers a low carbon solution to support the stability of the energy grid. This project provides a solution capturing the needs for energy storage, in the form of hydrogen, and flexible power generation. Making use of the existing installed gas turbine base with a modest retrofit provides a compelling and cost effective solution.

Doelstelling

The major objective is to develop a low emission gas turbine combustor retrofit for fuel flexible operation from 100% Natural Gas to 100% Hydrogen and any mixture thereof. Additional key objectives can be summarized as follows: 1. Cost effective retrofit for gas turbine in a load range from 1 to 300 MW, with a customer payback within 2-3 years. For smaller engines new installations are also applicable. 2. Low emissions of NOx, CO (sub 9 ppm) and CO2 (Carbon) in line with the environmental requirements of the future when natural gas is in the fuel mixture. When 100% Hydrogen is used, no CO and Carbon emissions are present. 3. Broad operational flexibility with the ability to rapidly ramp up and down in load to support the needs of energy grid stability 4. Provide competitive maintenance

Projectinformatie / Project information

Projectnummer / Project number
TWAS118005
Subsidiebedrag / Grant amount
€ 469.204,00

Algemene informatie / General information

Penvoerder / Secretariat
Ansaldo Thomassen B.V.

Publicaties en materialen / Publications and attachments

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  Eindrapport TWAS118005

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inspection intervals of at least 32,000 hours or 1,200 starts 5. Demonstrate successful operation with real engine hardware at atmospheric test conditions, which will then lead to high pressure and commercial engine demonstration by 2022 6. A cost level of the retrofit solution in line with the business case with a payback in 2-3 years.

Korte omschrijving

The engine proven FlameSheetTM combustion system will be the basis for the project development to achieve extended capability to operate flexibly from 100% natural gas to 100% hydrogen. A major challenge is the further development of robust hydrogen air premixing to ensure stable engine operation. Advanced analytical models will be used to benchmark previous high hydrogen operation on the FlameSheetTM. These analytical tools will then be used to further optimize the FlameSheetTM design to ensure stable 100% hydrogen operation. Test hardware will be designed, manufactured and operated at atmospheric test conditions, to validate the analytical predictions and demonstrate the 100% hydrogen capability of FlameSheetTM, while meeting the objectives described above. The project will be executed at the following locations: • OPRA Turbines: large scale test facility for atmospheric testing • TU Delft: model development & small scale laboratory tests • Ansaldo Thomassen: burner design & manufacturing

Resultaat

The result of the project will be a proven high hydrogen retrofit applicable to the majority of industrial gas turbines. The technology developed will feed the next phases of high pressure and commercial engine demonstration. Lessons learned during this project will be applied to the subsequent development and demonstration of FlameSheetTM technology.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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