

The development of a hydrogen turbine burner prototype

Publieke samenvatting / Public summary

Aanleiding

With the phasing out of natural gas, hydrogen appears to be a cost-effective solution for continuing to use the gas grid, and at the same time to realize clean electricity and heat in the industry. The combustion of hydrogen leads to solely water and energy as products and avoids any CO₂ emissions. Besides that, turbines can easily be used in environments where there is a large supply of excess renewable electricity that can feed electrolyzers to produce hydrogen. In this way, stored hydrogen can be used in case of direct electricity or heat demand to relieve (for example) the regular grid. Consequently, OPRA notices a large increase in the requests regarding the application of hydrogen in gas turbines.

Doelstelling

OPRA Engineering Solutions B.V. (hereafter: OPRA) and TU Delft will be working together on the development of the next-generation hydrogen combustion technology. This technology will meet the future requirements of a cost-effective, ultra-low emission combustion system for the OPRA gas turbine that can operate on 100% natural gas and 100% hydrogen, and any mix thereof. The challenge is to do this without compromising efficiency, startup times, and emissions of NO_x. This will be achieved by developing combustor designs with an increasing proportion of hydrogen blended with Natural Gas. Moving towards hydrogen gas turbines allows for cleaner combustion processes without any byproducts other than water. The H2 Flex

Projectinformatie / Project information

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Algemene informatie / General information

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project contributes directly to technology development that is required for the successful implementation of hydrogen chains and that will lead to improved performance in the short term. Besides that, the technology widens the applications for hydrogen as fuel.

Korte omschrijving

OPRA has set a target of being able to offer Gas Turbines capable of burning 100% hydrogen across the operational range and is further developing its Dry Low (NOx) Emissions (DLE) combustors to service the expected demand as a result of the unfolding hydrogen economy. The challenge is to do this without compromising efficiency (e.g. flashback combustion control and injection strategy), startup times, and emissions of NOx. This is being achieved by developing combustor designs with an increasing proportion of hydrogen blended with Natural Gas.

H2 Flex contributes directly to technology development that is required for the successful implementation of hydrogen chains and that will lead to improved performance in the short term. Improved performance is defined as significantly lower investment and/or operational costs, higher efficiency, less maintenance, wider applications, greater measurement accuracy, less use of scarce materials, and reduced spatial impact compared to the state of the art.

Resultaat

The overall result of H2 Flex is a developed and tested hydrogen turbine burner prototype, capable of burning a 70 vol.-% hydrogen mixture. This development specifically addresses the goal 'Burner technology for hydrogen' of the tender which includes topics such as modifications to turbine burners (taking into account possible effects on product quality) and burners for high-temperature heat avoiding emissions of other harmful components (such as NOx). During H2 Flex, the aim will be to achieve a 70 vol.-% hydrogen mix for the burners since CO2 reduction improvement develops non-linear after 50 vol.-%. The estimates are realistic, as OPRA has already been able to carry out tests with a 30 vol.-% hydrogen mix. It is expected

that the biggest technical challenge will be to rise
above 50 vol.-% hydrogen.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in
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