

Gas turbine combustion

Matching flame stability, fuel flexibility and emissions

Today's gas turbines combustion chambers are designed for stable combustion of a large variety of gases, low pollutant emissions and incredible energy density of around 150 MW/m³. For the combustion of natural gas, dry low NO_x combustion systems are standard. These combustion systems have a delicate equilibrium between flame stability and emissions and are prone to changes in fuel compositions, ambient conditions and operating regimes. In the worst case, this leads to damage of the combustion hardware, e.g. due to overheating of the fuel nozzles. ENGIE Lab Laborelec keeps up with the latest evolutions in gas turbine burner design through the projects portfolio. Moreover, dedicated services are offered to power plants in order to cope with their combustion issues.



FUEL FLEXIBILITY

Operational as well as fuel flexibility are key to make a power plant profitable. ENGIE Lab Laborelec investigated both natural gas fuel flexibility and liquid (bio-) fuel flexibility, drawing out guidelines to cope with changing gas qualities and investigating the technical and economic feasibility of burning liquid bio-fuels in combined cycle gas turbines (CCGTs). Under evaluation are the material compatibility, the combustion behaviour, and the sustainability of different/various bio-fuels.

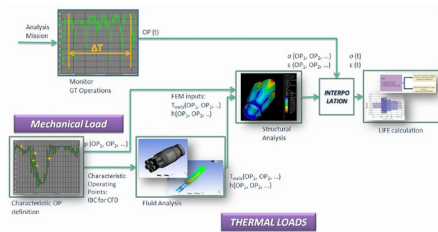
LIMOUSINE PROJECT: ESTIMATING THE REMAINING LIFETIME OF COMBUSTOR PARTS

The impact of the combustion instabilities on the life of the combustion hardware is still unknown and difficult to evaluate. Thanks to the multidisciplinary knowledge at ENGIE Lab Laborelec, we are working to create a realistic model based on real-life operational data, material characteristics, and combustor geometry. The model will be useful to evaluate the effects of variations in combustion modes, airflows, and many other parameters on the combustor's expected lifetime.



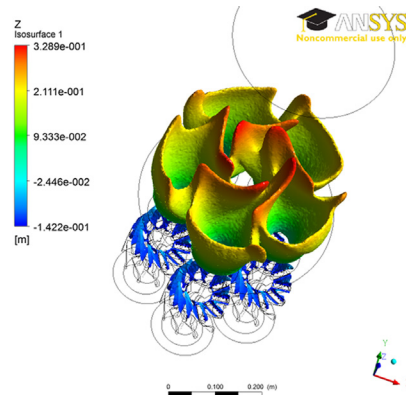
COMBUSTION DYNAMICS MONITORING AND TUNING TOOL

In 2005, ENGIE Lab Laborelec developed its own Combustion Dynamics Monitoring and Tuning Tool for can-annular combustion chambers. The system allows the monitoring of vital combustion parameters such as pressure, temperature, and combustion dynamics. It can be used for early warning detection, facilitating root cause analysis and combustion tuning. The system's implementation has already led to positive results in the BeNeLux region.



ROOT CAUSE AND FAILURE ANALYSIS OF THE COMBUSTION PROCESS

Finding the root cause for combustion problems is not an easy task as combustion is influenced by many variables. Thanks to its expertise, ENGIE Lab Laborelec is frequently called in to perform RCFA or to verify an (external) RCFA carried out by the turbine manufacturer or an independent organization.

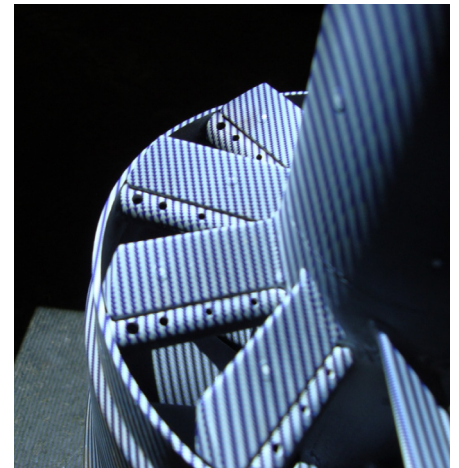
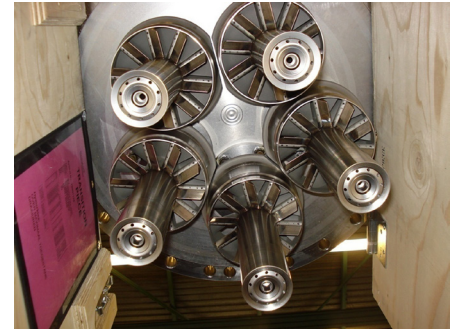


TUNING GUIDELINES AND FOLLOW-UP

During a combustion tuning, the emissions and combustion stability are balanced out by optimizing the control settings that regulate the fuel flow to the different burners. Experience at many power plants shows that the lack of knowledge of some tuners can lead to situations in which the GT is limited in its operation. ENGIE Lab Laborelec has set up tuning guidelines for the operators of V94.3A and 9FA/FB gas turbines to understand what the tuner performs during its service. If required, we can provide assistance during tuning or when dealing with any combustion issue.

COMBUSTION COURSE

ENGIE Lab Laborelec provides gas turbine combustion courses to improve the knowledge of the operator concerning the combustion systems installed in their power plants.



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Contact

ENGIE Lab Laborelec
Rodestraat 125
1630 Linkebeek

T. +32 2 382 02 11
info.laborelec@engie.com