Laborelec
RESEARCH & INNOVATION

ETN Global Hydrogen report 2024

27/03/205

ENGIE

PUBLIC | RESTRICTED | INTERNAL | SECRET

ETN report

- The project is a study to assess, design and adapt all equipment, new and existing, to run at a fuel blend of 45% vol% H2 and 55% NG. In accordance with all Engie standards.
- External battery limit is the future H2 pipeline on the delivery point of the network. Delivery point withing the boundaries of the power plant

The system needs to take into account the following operation limitations:

- In case of GT trip or load rejection the H2 blending is tripped

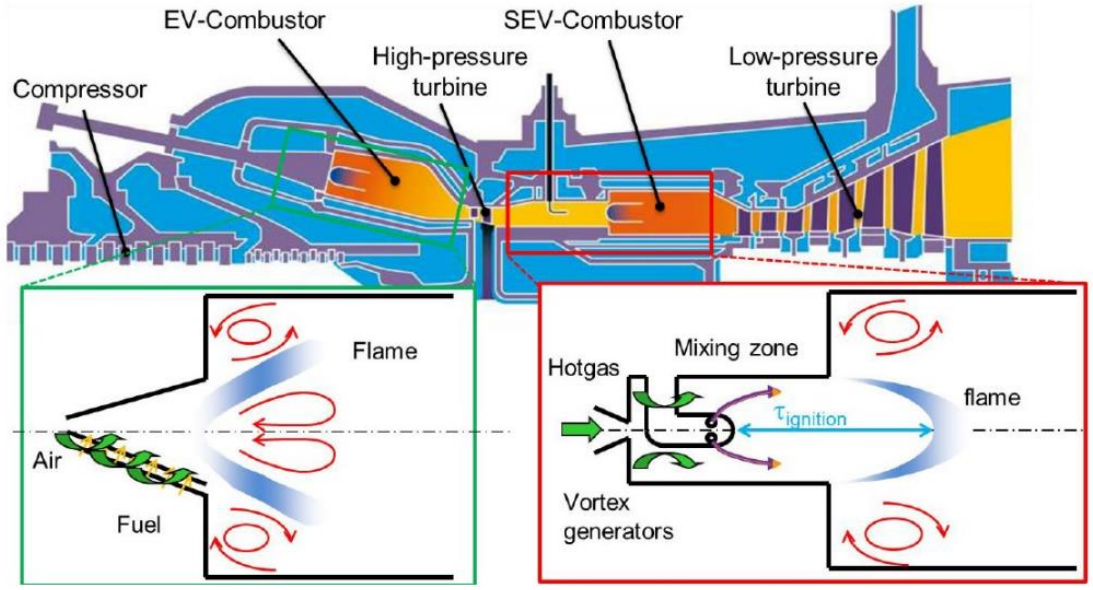
- The max H2 load variation gradient

- Start stop operation of GT trip or ramping up-down from zero load to minimal load with blending is not included

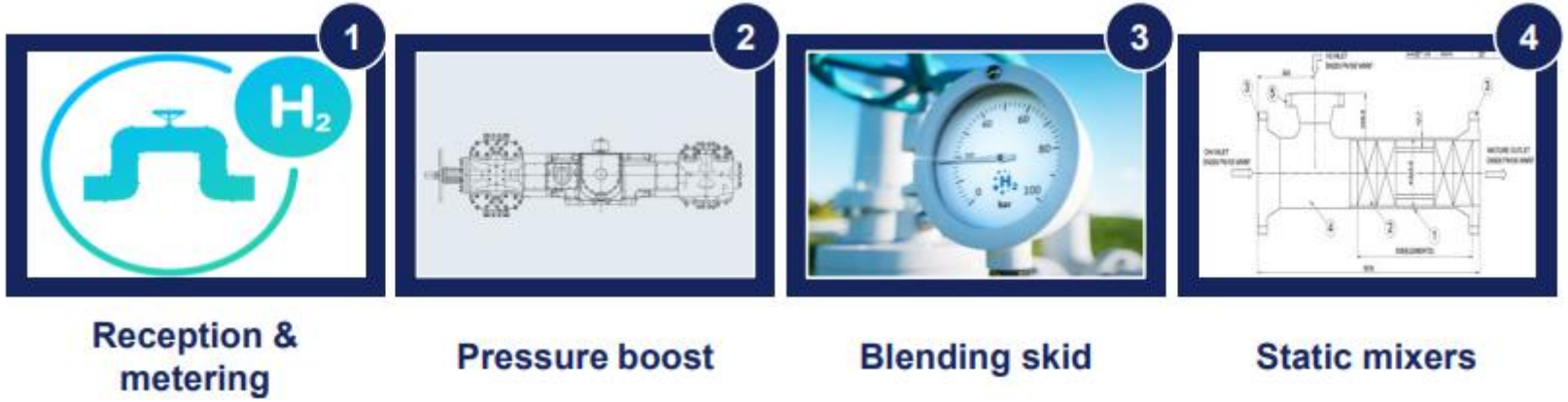
- H2 blending is allowed in the operational range of min load – max load must scope with a cycling mode of normal or even fast gradient

GT Thermal block

- Where to inject the hydrogen to to have optimal conditions regarding:
  - NOX
  - Efficiency
  - Capacity
- Several scenario's have been simulated
  - Max H2 at current OPC => app. 30 vol% H2
- Above, NOX mitigation measurements are needed:
  - Derating
  - Water injection
  - SCR



GT Fuel system design



- H2 flow 45%: app. 110.000Nm³/h
- The powerplant needs a higher pressure then supplied by the H2 net => need for compression
  - Type of compressor
  - Redundant (yes/no)
  - Footprint (compressor, motor, aux, water console => app. 70m²)
  - Important CAPEX driver
  - Important OPEX driver
  - Electrical power consumption

Safety impact on power plant

Basics for process design:

"Keep it simple"

Limit the total hydrogen volume as much as possible (SEVESO threshold)

Isolation of sub-systems for maintenance: DB&B

Challenges:

Gasturbine enclosure (ventilation requirements for hydrogen, compatibility of instruments)

Venting or flaring to be applied for hydrogen?

Compressor enclosure for noise control versus ventilation

Human errors and mitigating measures

HAZID brainstorming was executed for the hydrogen fuel system, facilitated by Laborelec.

Critical topics

- Jet fires, heat radiation, pressure waves and domino effects
  - Additional measures can be required to mitigate these risks!
- Hydrogen is considered an indirect green house gas: to be considered if venting is applied
- Locations of vents/flares and safety distances
- ATEX zones of hydrogen fuel (mix) extending over existing equipment.

HAZOP was executed for the hydrogen fuel system, facilitated by Laborelec.

P&ID's / PFD's and Functional Description were evaluated and improved.

Critical topics

- Venting and purging for maintenance and for emergency shutdown
- Mitigation measures for human errors
- Control logics and safeties
- Disruption of hydrogen supply → speed of controls to compensate natural gas supply → risk of GT trip
- Hydrogen leaks, ventilation and ATEX compliancy

GT Enclosure CFD

Optimisation of ventilation and gas detection systems

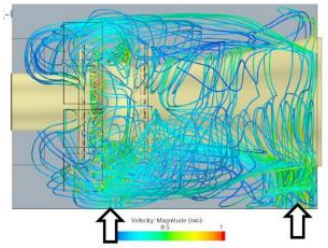
Minimisation of explosion hazards

Enclosure readiness for 100% H_2 → Futureproof for further H_2 increasements

5

CFD Study

Analysis of 3 (worst case) gas leakages



Laborelec

RESEARCH & INNOVATION

laborelec.com