ETN's 20th Annual General Meeting & Workshop

"Accelerating turbomachinery pathways to net-zero"

19-21 March 2024, Leiden, the Netherlands

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Report from the Chairs on takeaways/actions

Outcomes of the session – Digitalisation and diagnostic

Topic	Outcome of the discussion	Action
Technical session	- Make the best use of data you already have, using matured techniques - AI/digital solutions are widely investigated, but not widely deployed	See row below on WG
WG on digitalisation and diagnostic	Expressed interest in: 1. Instrumentation for operation and maintenance operation 2. Machine Learning / AI 3. Development of Digital Twins 4. Data Management 5. Cyber security 6. Sensors for instrumentation for GT development	- Identify volunteers in your organisation (also young engineers) - Write chapter of Working Group (scope, objectives, timeline) - Organise monthly/bimonthly meetings to kick-off activities

Outcomes of the session – More efficient and/or innovative cycles (1)

Topic	Outcome of the discussion	Action
Flexibility of Gas Turbines as they start more times and run fewer hours (utility)	- Many more starts per year and fewer running hours as VRE penetration increases. - The more efficient power plants will participate in the market for more hours. - Optimization of starts, reducing start-up time and having better ramp-up rates. - Part load vs peak efficiency, minimum load.	- Understand effect on CCGT, compare flexibility of different solutions for bottoming cycle

Outcomes of the session – More efficient and/or innovative cycles (2)

Topic	Outcome of the discussion	Action
Use of alternative fuels to decarbonize	- While decarbonizing with AFs, fuel flexibility is of utmost importance. - Need to develop combustion systems that can deal with different fuels and at different percentages.	- Explore options in conjuntction with H2 WG - Evaluate indirect fired cycles for implementation of multi fuel
Decarbonization of off-shore platforms	- Minimize weight and footprint. Options: 1. Conventional/Innovative Bottom Cycles 2. Reducing the weight of HX. 3. EGR for enabling cost effective CCS. 4. Lighter CCS 5. High Efficient Air Filtration System (1% to 3% emission reduction)	- Re-run the off-shore sCO2 case using data approved by technology provider with confidence ranges instead of literature data - Compare existing / ongoing eveluations

Outcomes of the session – Product circularity

Topic	Outcome of the discussion	Action
High temperature alloy for AM	- Modification of traditional alloys underperform compared to state-of-the-art materials - Investigation of new alloy composition but need for developing a structure to characterize them	- Establish a framework for assessing and comprehending new superalloys - Additional testing and experiments for new alloys required
Manufacturing of structures (different organisations, same specs)	- Similar mechanical properties as expected (defects at cooling holes) - Differences within same organization due to calibration of machines - Production of the sets different amongst organizations.	- Definition of quality control procedures - Get insights into how AM machines work - Any organisation can join the consortium, inform ETN
AM projects	Agreement to launch new projects (Non-Destructive Testing, Machine Control Framework for LBPF)	Meeting in April to decide new project

Outcomes of the session – Low carbon solutions (1)

Topic	Outcome of the discussion	Action
Slido ranking of the task forces of the H2 WG	- Topics of interest are well covered by the WG - Ranking results were • Project database • H2 report update • Ammonia / alternative fuels - Iron combustion as possible new topic	- Send a reminder to the members to fill the database - Contact selected members for their input to the H2 report

Outcomes of the session – Low carbon solutions (2)

Topic	Outcome of the discussion	Action
Slido ranking of possible CCS topics to be followed up	- With work on operational flexibility and knowledge sharing the task force is on the right track - Possible new topics are 1. Integration with CCGT 2. Exhaust gas recirculation	New topics will be shared with CCS task force
Presentation of Jon Runyon about Uniper CCS projects	• The operation of a CCS plant differs significantly from a CCGT plant • There is a competence gap in what is needed for the operation of such a plant	The topic will be taken to the CCS task force

Outcomes of the session – Product reliability

Topic	Outcome of the discussion	Action
Rotor lifetime Inspection and evaluation	- Procedure for onsite testing of parts, extracting material properties and evaluating degradation - Small punch testing aligned with micro-sampling devices - Rotor integrity and life (end of life)	- What else can done for a rotor lifetime assessment (on-site inspection)? - How about welded rotor? Other rotors?
Hot gas part degradation TBC state-of-art & evaluation	- Degradation and failure modes of TBC was presented (experience shared by Juelich Forschungszentrum)	- Life assessment for: ○ Single crystal parts ○ Parts from the back-up engine ○ TBC coating life (methodologies to be developed)

Outcomes of the session – Integrated energy systems

Topic	Outcome of the discussion	Action
Discussion on the objectives	- Gaps to close	
Open discussion	- Comparison metric with RES: Levelized Cost of Reliable Electricity (CAPEX) - Necessity of pre-engineered solutions - Scenarios - Flexible heat to power ratio - Energy storage (electricity, heat, gas)	- Consider the open questions in the WG new activity - Get more active partners/members involved to solve the highlighted issues