Turbomachinery sCO2 applications					
WG Name	sCO2	**Chair**	Marco Ruggiero (Baker Hughes)	**Co-chair**	Albannie Cagnac (EDF); David Sanchez (University of Sevilla)
Project lead	**Giacomo Persico (Polimi) / David Sanchez (University of Sevilla)**				
Core team	**Paolo Silva (Polimi); Renaud Le Pierres (Heatric), Stefan Glos, Albannie Cagnac (Edf); Rene Vijgen (ETN); Rasmus Rubycz; Jonas Rydland (ConocoPhilips); Olaf Brekke (Equinor); Dominique Orhon (TotalEnergies); Marco Ruggiero (Baker Hughes)**				
ETN officer	**Jitka Spolcova**				

Initiative description

sCO2 is still looking for a sweet spot and is usually challenged by other more established/mature technologies (like steam and ORC for indirect fired or traditional power generation for direct fired). This initiative aims at looking into several applications and discover/uncover which could be the edge of sCO2 against its competing technologies (i.e. efficiency, weight, footprint eventually and TCO, €/MWh). Potential applications are: WHR (off-shore and on-shore), Nuclear, CSP, fossil power generation, (thermal) energy storage . In 2023, the WG focused on three areas of work: dissemination, engagement and assessment of technology:

1. Dissemination: the webinar series on sCO2 technologies carried on, focusing on an ever increasing, international audience. The incorporation of relevant speakers not only from Europe but also United States is seen as a very positive symptom of the increased outreach.
2. Engagement (of ETN members): sCO2 power cycles are less mature than ETN's reference technology (gas turbines), which hinders the engagement of ETN members representing the end-user community. Therefore, the leadership of the WG has made large efforts to try and capture the interest and active participation of end-users, through consultation about the potential applications of interest and the associated main drivers to ensure the sustainability of their primary business.
3. Assessment of technology: in 2023, the WG has worked on assessing the potential of sCO2 power systems as a retrofit solution for off-shore platforms in the O&G industry.

Objective setting

- To identify low(null)-carbon solutions for the conversion of thermal or chemical energy into mechanical power (and heat); in particular, solutions utilising supercritical Carbon Dioxide power cycles.
- To evaluate the applicability of sCO2 power systems in key strategic applications for the ETN membership: techno-economic feasibility and positive contribution to the energy trilemma
- To raise awareness of the potential benefits of sCO2 power cycles, their current technology readiness level and technology gaps.

Activities expected to be continued/started in 2024

- Webinar series continued
- Series of reports assessing the techno-economic feasibility of sCO2 power systems in selected applications
- Technology, Supply Chain and Standard/Regulatory gap matrix identifying the outstanding challenges to be overcome if the technology is to be deployed in the market
- Roadmap to construct a demonstrator of small, modular sCO2 power system for WHR applications where compactness (footprint) and weight is a primary driver, co-funded with public and private money.

Implementation of the activities

Project execution

Please describe the role and the involvement of the participating members. Estimate the required manhours.

- The ETN office will continue organising the webinar series: the estimated effort is 150 hours (one webinar per quarter)
- Techno-economic feasibility studies(*): the estimated effort is 250 hours (one report) to 500 hours (two reports)

- University members: lay the foundations of the analysis carry out techno-economic assessments.
- Technology providers: advise on performance data and design specs, as well as support the activities carried out by the university members.

- End-users: describe the boundary conditions at the interface with the user, share information to set up the economic analysis, provide operational data to ensure representativity of the assessment.Gap matrix: all members of the WG will contribute to creating the technology/standard/regulatory gap matrix (the collective effort needed cannot be estimated). The ETN office will coordinate this task, with an estimated effort of 100 hours (~10 hours/month)
- Roadmap to demonstrator: a task force stemming from the members involved in the development of the techno-economic reports will be created. The effort required to elaborate the roadmap is estimated at 125 h

(*) Confidentiality might apply

Project finances

Specify if additional funding is required, and for which activities.

No additional funding needed at this stage

Meeting schedule and dissemination

Please explain the dissemination strategy and meeting schedules.

The dissemination strategy is built upon three pillars: webinar series organised by the ETN Office, publication of journal papers, presentation of papers at conferences and other technical meetings.

One webinar will be organised every three to four months.

Task forces working on the technical reports will meet every two months, at least

Deliverables & Milestones			
Deliverable 1	Webinar 7/8/9	**Timing**	Q2/Q3/Q4 - 2024
Continuation of webinar series. Topics to be decided			
Deliverable 2	Detailed analysis of GT-sCO2 bottoming systems in off-shore platforms	**Timing**	Q3-2024
Follow-on paper to the work presented at ASME Turbo Expo 2023. This paper will include design of components and a more accurate estimate of the weight and size of major equipment, in particular the WHR heater			
Deliverable 3	Unconstrainted optimisation of GT-sCO2 combined cycles	**Timing**	Q3-2024
Paper assessing the impact of global GT-sCO2 optimisation on gas turbine design and performance. Definition of practical limits			
Milestone 1	Second webinar of 2024 held	**Date**	Q2-2024
Following the objective to organise 3-4 webinars, a minimum of 2 webinars must be held before the summer break			
Milestone 2	Technology gap matrix shared with members of the WG	**Date**	Q4-2024
The matrix where the members will be able to list the current needs of sCO2 technology to move forward must be shared before the end of Q2-2024 to make sure there is enough time to produce the information before the end of the year			