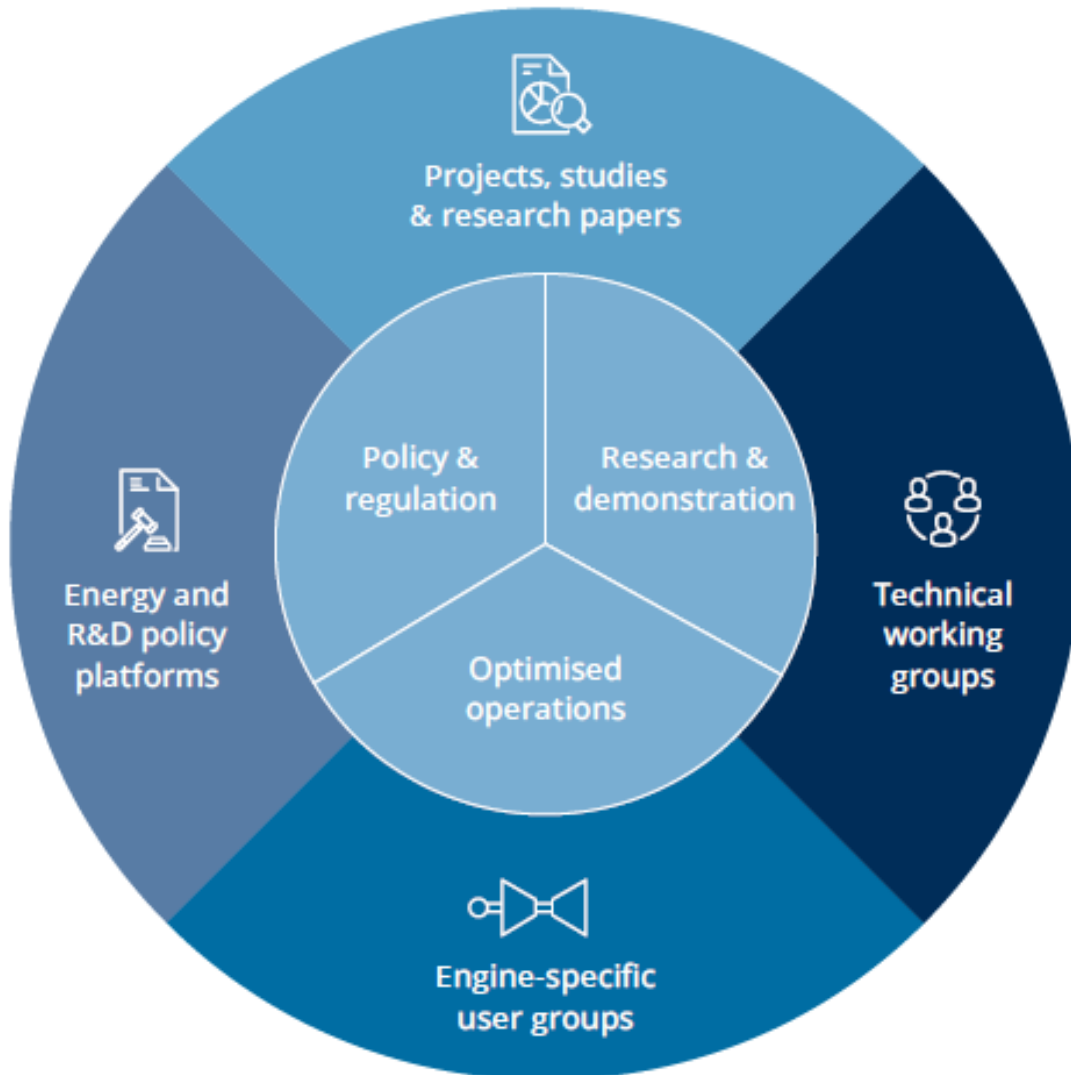


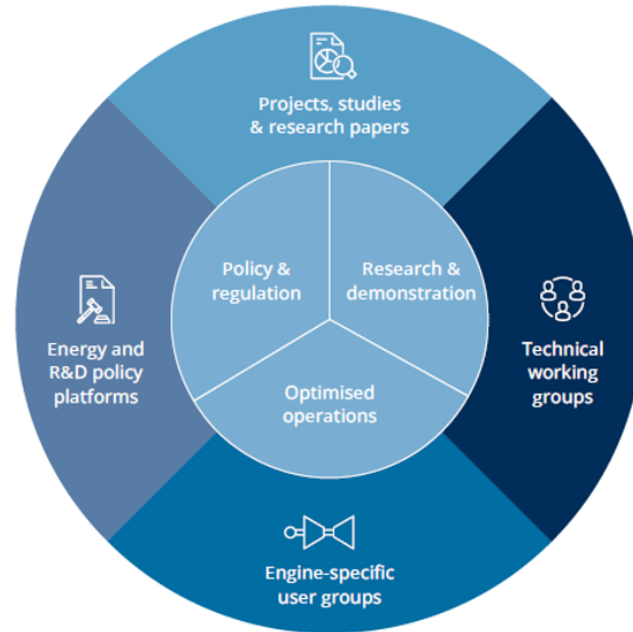
Current ETN activities

Christer Björkqvist, Managing Director,
ETN Global



- Non profit association with 120 member organisations:
 - ✓ Utilities, Gas companies, Industrial users
 - ✓ Gas turbines OEMs
 - ✓ suppliers and service providers
 - ✓ consultancies
 - ✓ research institutes and universities
- 22 countries: Europe, Asia, & North America
- 1900+ Participants





Energy and R&D Policy

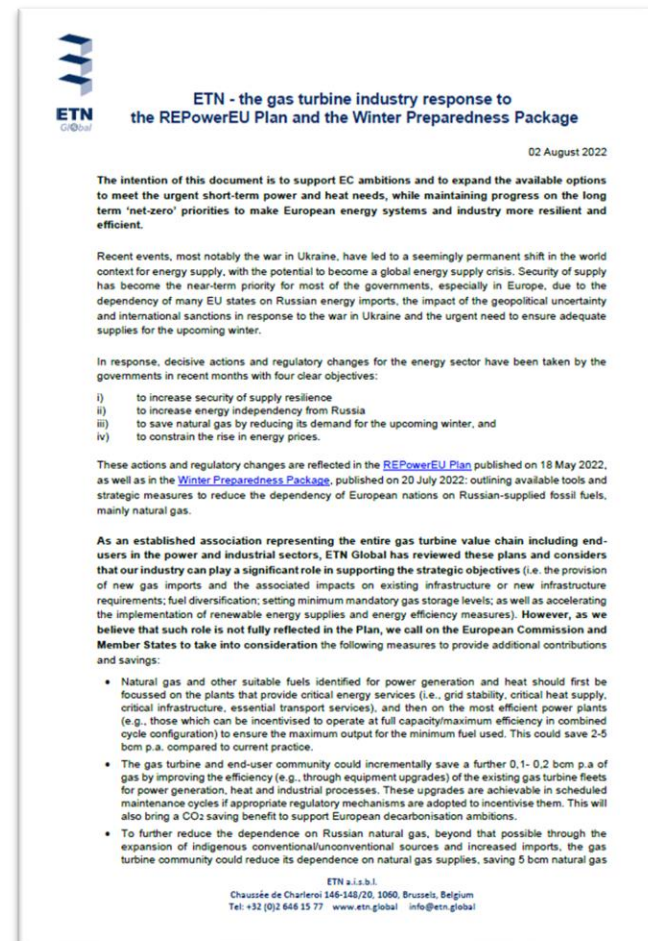
ETN response to the REPowerEU Plan and the Winter Preparedness Package – Aug 2022



Objective: to highlight additional available options to meet the urgent short-term power and heat needs,

while maintaining progress on the long term 'net-zero' priorities to make European energy systems and industry more resilient and efficient.

Highlighting short-term and medium-long terms measures



Key messages in the response

Short-term measures

1. Gas and other suitable fuels identified for power generation & heat should first be used in:
 - a. plants that provide critical energy services (i.e., grid stability, critical heat supply, critical infrastructure, essential transport services), and then on
 - b. the most efficient power plants (e.g., those which can be incentivised to operate at full capacity/maximum efficiency in combined cycle configuration) to ensure the maximum output for the minimum fuel used. **Potential savings 2-5 bcm p.a**
2. Improving the efficiency (e.g., through equipment upgrades) of the existing gas turbine fleets for power generation, heat and industrial processes. **Potential savings: 0,1- 0,2 bcm p.a of gas**
3. Additional use of conventional/unconventional sources (dual fuels) like liquid fuels, biogas or other process-derived gases. **Potential savings: 5 bcm**

Medium/ long-term measures

Shifting to carbon-neutral dispatchable power by using H2 and other clean gases for power generation, heat and industrial processes. **Potential savings in 2030 onwards: 30 bcm p.a**

Supportive regulatory framework required!

EU Platforms and initiatives

ETN's active participation for dissemination and future R&D project opportunities

- **SET Plan** (Strategic Energy Technology Plan)

- Action 5 – New Materials and Technologies for Buildings
- Action 6 – Energy Efficiency for Industry
- Action 9 – Carbon Capture and Storage (cooperation with ZEP)



- **ETIP-SNET** (European Technology and Innovation Platform – Smart Networks for Energy Transition)

- Working Group 3 – Flexible generation



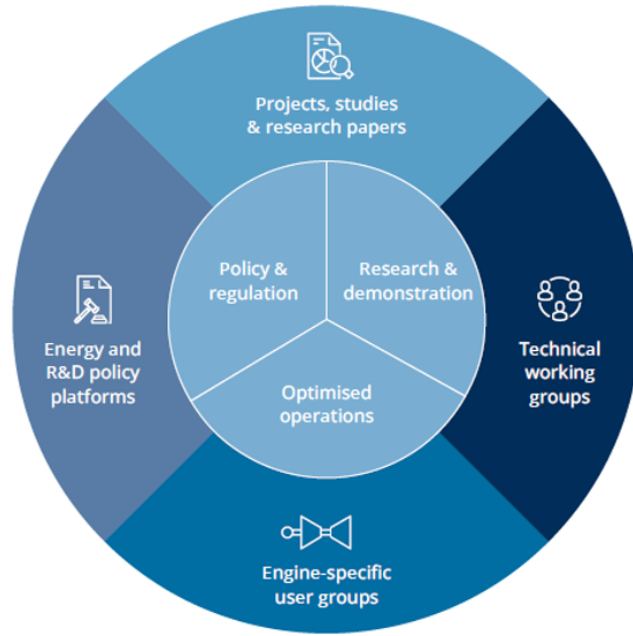
ETIP SNET

- **BRIDGE** (coordinating energy research and innovation projects across the EU) – active through ROBINSON



- **Clean energy for EU Islands** – active through ROBINSON



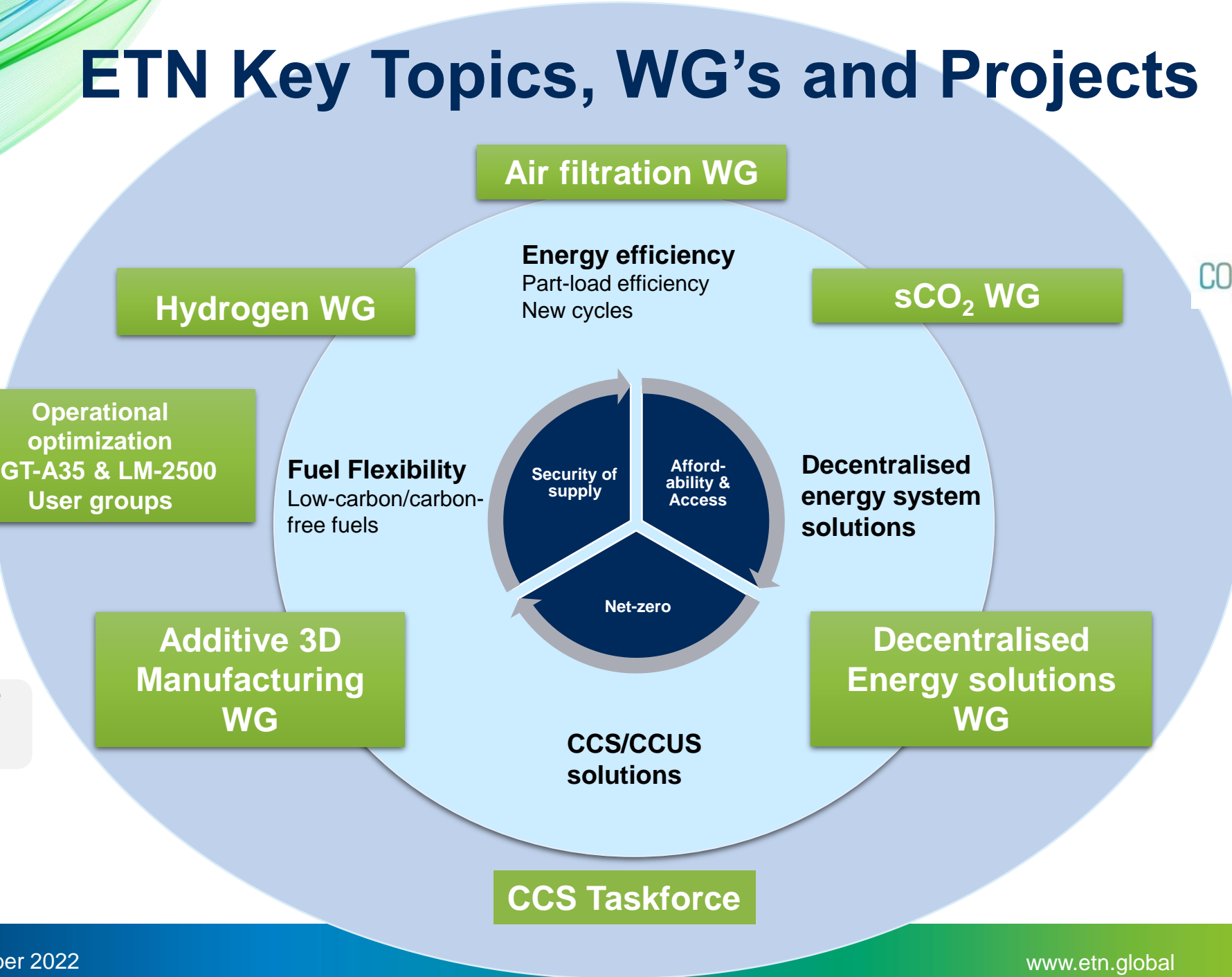


Technical Working Groups

ETN Key Topics, WG's and Projects



AM Machine
Evaluation
Project



Hydrogen Working Group

Chair: Peter Kutne, DLR
Co-Chair: Geert Laagland, Vattenfall

Objectives:

Accelerating the development and use of hydrogen-based gas turbine technology by:

- Identifying potential barriers, and exploring:

Economic aspects &
business cases

Demonstration
projects

Operational issues/effects
on GT components

Retrofit solutions for high
hydrogen-content fuel

Safety aspects

Research needs

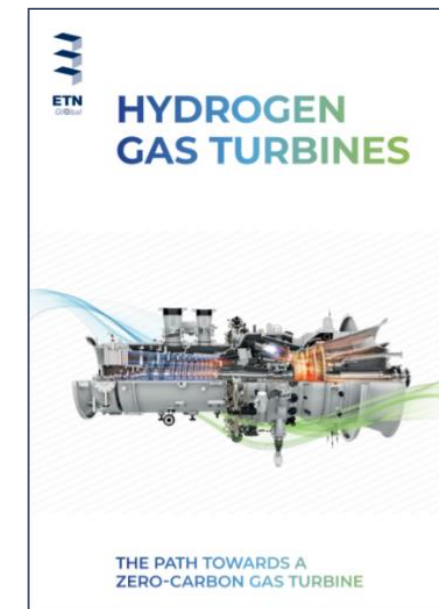
- Exploring cooperation opportunities to ensure safe, reliable and cost-efficient solutions for existing and future fleets

Activities:

- Taskforce “GT Enclosure standard for hydrogen fuel” with the objective to develop an ISO safety standard
- Techno-economic study (Young Engineers Committee) – accomplished & published
- Review paper “Addressing the combustion challenges of Hydrogen addition to Natural Gas” – finalised



The path towards a
Zero-Carbon Gas Turbine
Published in January 2020



Download at
etn.global/hydrogen-report

Air Filtration Working Group

Chair: Olaf Brekke, Equinor
Co-Chair: Dominique Orhon, Total Energies



Objectives:

Improve the quality and flexibility of Air Filtration systems by:

- Allowing the users to have a single point of reference for state-of-the-art filtration technology
- Addressing air filtration issues through projects of common interest



ETN liaison members of:

- ISO/TC142 “Cleaning equipment for air and other gases”
- ISO/TC 192 “Gas Turbines”



Activities:

- Development of ETN standard is for test methods of air intake filter systems for rotary machinery in offshore applications (harsh environment)

Additive Manufacturing Working Group

Chair: Ulli Klenk, Siemens Energy

Co-Chair: Jan de Roos, Shell



Objectives:

Strengthen the cooperation between stakeholders of the turbomachinery value chain on additive manufacturing (AM) topics by:

- Exchanging knowledge and experiences focusing on the added value of AM
- Cooperating on AM practices for applications in the energy sector

Activities/ Projects:

- Additive Manufacturing Machine (L-PBF) Evaluation Initiative

Objective to better understand the capabilities and boundaries of the technology for the energy industry by reviewing market-available solutions, with the ultimate goal to provide supportive ground to push these limits further. [More info](#)

AM Best Practices
Published in 2019



Download at
etn.global/ETN-AM-Best-Practices

Supercritical CO₂ Working Group

Chair: Marco Ruggiero, Baker Hughes

Co-Chairs: David Sánchez, University of Seville; Albannie Cagnac, EDF



Objectives

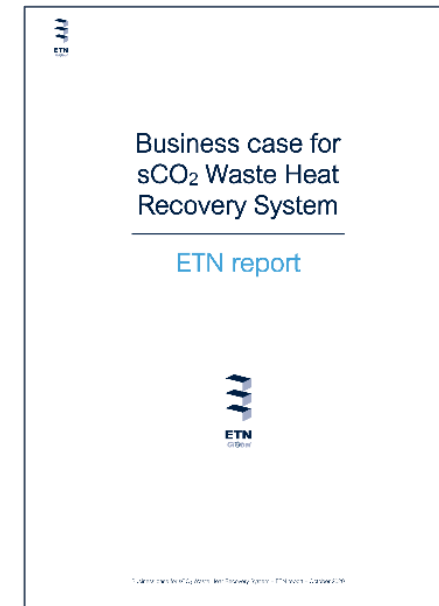
Develop, enable and optimise the use of supercritical CO₂ power cycles by:

- Highlighting potential use, applications and benefits
- Addressing operational issues/effects on components (turbomachinery, heat exchangers and combustion systems) related to the use of sCO₂; as well as operational safety aspects
- Exploring market opportunities
- Exploring strategic alliances internationally to gain economies of scale worldwide
- Paving the way for funding opportunities by highlighting the research needs on sCO₂

Activities

- Survey on sCO₂ accomplished at the beginning of 2022
- Temporary focus on the sCO₂ bottoming cycle for off-shore applications; two ASME papers will be produced on this topic

Business case for sCO₂ Waste
Heat Recovery System
Published in October 2020



Download at
etn.global/sco2-whrs-case

Decentralised Energy Systems WG

Chair: Peter Breuhaus, NORCE

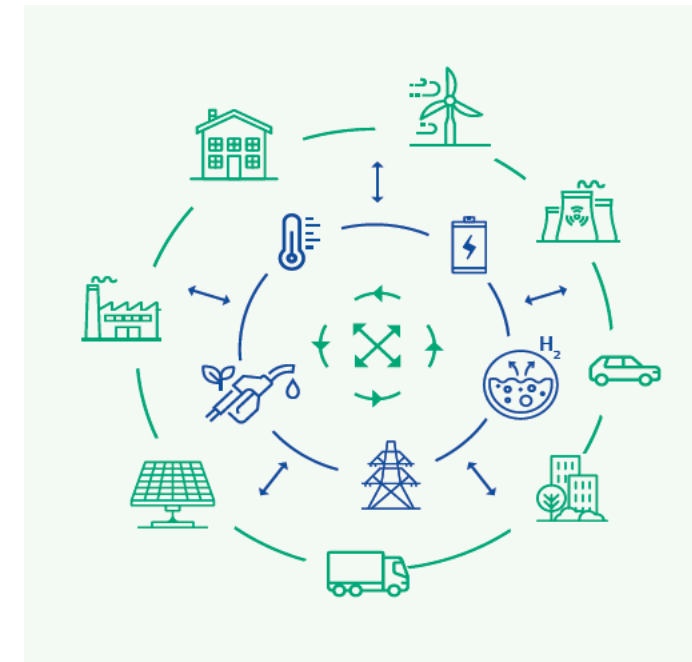
Co-Chair: Enrico Bianchi, Ansaldo Energy Green Tech

Objectives:

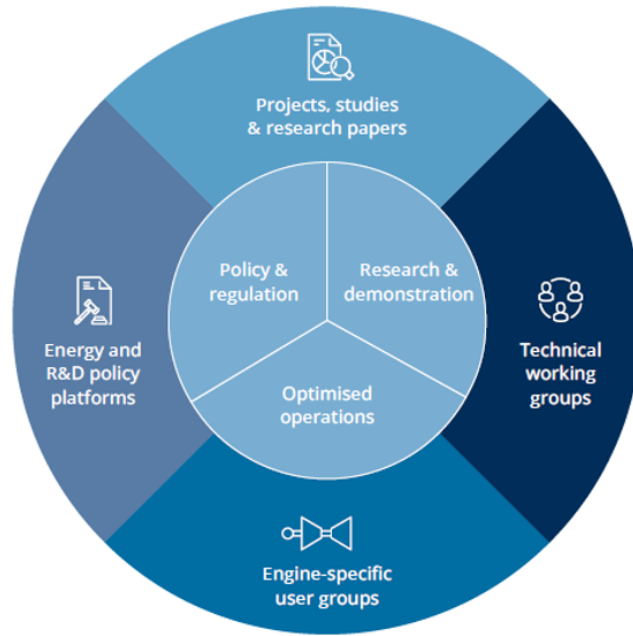
- Bring together stakeholders of the value chain for decentralised energy system solutions with dispatchable micro and small gas turbines
- Explore market opportunities and solutions
- Accelerate the development of cost-efficient integrated secure technology solutions
- Gas turbine integration into decentralised sustainable energy systems and its interactions with other systems components

Activities:

- Report on “Decentralized Energy Systems: Towards Carbon-Neutral Energy Solutions for Gas Turbines” to be presented at AGM in March 2023:
 - Chapter I on “Decentralised Energy Systems: a State of the Art”
 - Chapter II on “Integrating Gas Turbines Technologies to DES: a New Challenge”



Source: EU strategy on energy system integration, July 2020



Engine Specific Engine Groups

ETN Engine specific User Groups

In person meetings 2023



SGT-A35, Equinor, Stavanger May 2022

SGT-A35
USER Group
2023 meeting

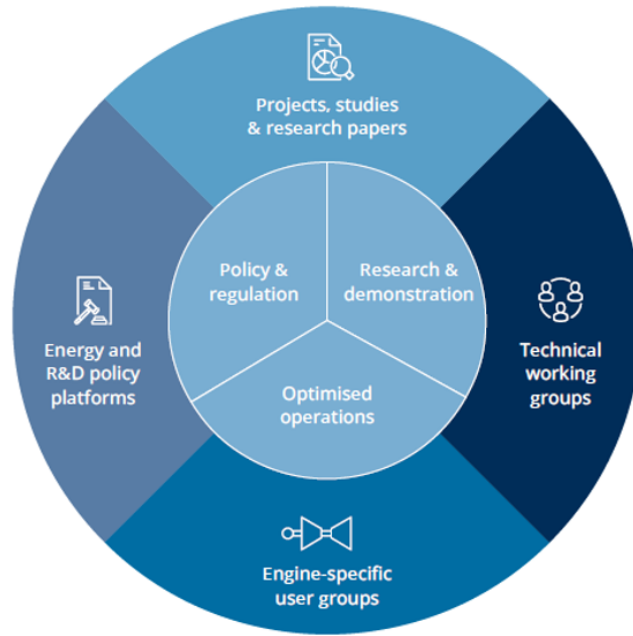
(9th & 10th) or (10th & 11th) of May 2023
Aberdeen, Scotland



LM2500, Total Energies Aberdeen 2022

LM2500
USER Group
2023 meeting

(6th & 7th) or (7th & 8th) of June 2023
BP, London, UK



Project Studies and Research papers

ETN Projects



2021-2025

ETN's role: coordination, dissemination and communication activities



2020-2024

ETN's role: coordination, dissemination and communication activities



2020-2024

ETN's role: dissemination and communication activities



2022

AM Machine Evaluation Project



co2olheat-h2020.eu



robinson-h2020.eu



flexnconfu.eu



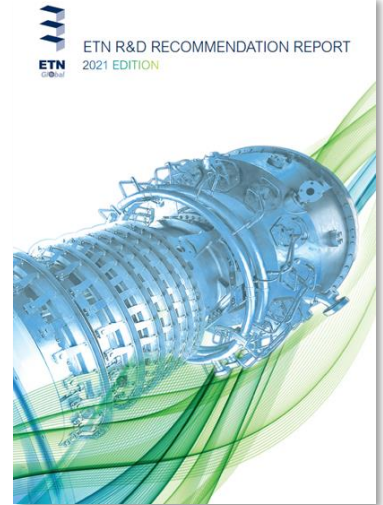
etn.global



These projects have received funding from the European Union's Horizon 2020 research and innovation programme:
PUMP-HEAT: GA 764706; FLEXnCONFU: GA 884157; ROBINSON: GA 957752; CO2OLHEAT GA101022831

ETN R&D Recommendation Report

Edition 2021 to be updated in 2023



Topics: Market conditions & policy framework

Operational flexibility

High efficiency (also at part load)

Extended fuel spectrum

Emissions

Decarbonisation

Advanced cycles

System integration and energy storage

Decentralisation

Materials

Advanced repair

Digitalisation

Reliability, availability, maintenance

Sensors & instrumentation

Condition monitoring & lifing

Power
Generation

Oil & Gas

Industrial

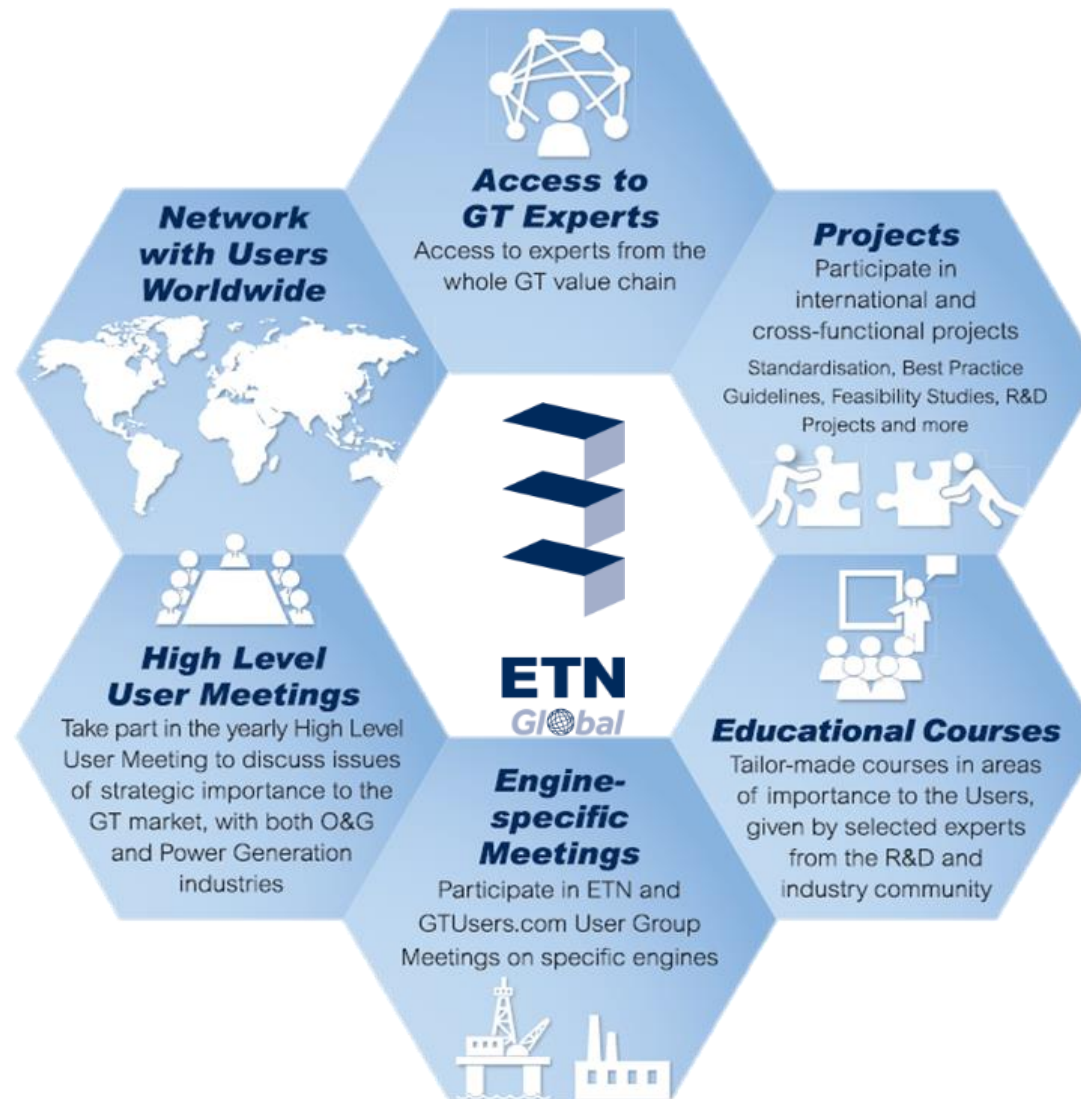
Systems integration

Decentralised systems

Flexibility (Fuel & Operation)

Digital solutions

Cooperation for a successful energy transition!



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