

Newsletter



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ETN Global is a non-profit association bringing together the entire value chain of the gas turbine technology community. Through cooperative efforts and by initiating common activities and projects, ETN encourages and facilitates information exchange and cooperation to accelerate research, development, demonstration, and deployment of safe, secure and affordable carbon-neutral energy solutions by 2030.



Christer Björkqvist
Managing Director

Switching gear towards a rapid energy transition has never been more important!

The last years have not been short of challenges: climate crisis with catastrophic extreme weather events; COVID-19 Pandemic; the energy crisis; and now the Russia-Ukraine war resulting in further natural gas price volatility due to the uncertainties on supply. Such market instabilities are not expected to disappear. On the contrary it seems to be the new normal that will require a closer cooperation and coordination among all stakeholders to ensure a successful energy transition. This was highlighted and agreed on at ETN's Annual General Meeting that successfully took place in Brussels at the end of March.

It was further agreed that we should identify a portfolio of the most promising solutions documented in a detailed roadmap with clear timelines. Such coordinated market view will be needed to trigger and accelerate the required developments and investments.

It is time for the user community to move into the front seat and become a navigation co-driver highlighting the most promising path to follow. ETN will guide and facilitate this coordination process with support of our Working Groups. We will also assist our members to act on this information and to facilitate cost-efficient cooperation by initiating new projects and common activities that can accelerate the transition and increase the chances of successful and timely developments.

Parallel to our ongoing projects (FlexnConfu, Robinson, CO2OLHEAT and Additive Manufacturing initiative) there are already additional relevant research opportunities and activities in the pipeline. This is a result of ETN's active involvement in different policy & technology platforms over the past years as well as the technical input that we have provided in various publications and a wide dissemination of our R&D and Hydrogen recommendation reports.

If you missed our AGM and Workshop, which was highly appreciated by the participants, you still have a chance to download the presentations from our website that contain market and policy outlooks, inspiring technical presentations on ongoing research & demonstration, as well as upcoming opportunities for our industry. In order not to miss the next networking occasion, you can already pencil in the 12-13 October in your agenda for ETN's autumn workshop. The objective of this workshop will be to progress the road mapping mentioned above. Before that we have many other smaller Working Group and User Meetings, so keep an eye on ETN's event agenda. Another opportunity for networking will be at the ASME Turbo Expo in Rotterdam where ETN will have a stand.

Looking forward to catching up and meet in person at one of these upcoming events!

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ETN's Annual General Meeting and Workshop

Our first face-to-face meeting in 2 years!

ETN's 18th Annual General Meeting (AGM) and Workshop that took place on 29 and 30 March 2022 was a successful face-to-face meeting with a virtual participation option after 2 years of virtual-only gatherings. We would like to thank our sponsors, exhibitors, speakers as well as all the members for their support and active participation, great discussions, excellent presentations, and wonderful ideas that will be harvested for the implementation of a new ETN Roadmap to be included into ETN's activities.

A 2-day event full of presentations and discussions

ETN's 2-day event commenced with an AGM, presenting an annual report on governance, performance and activities within our Working and User groups, EU- and industry-funded projects, Young Engineers Committee, and ETN's involvement in EU's research and innovation activities. A new ETN Board of Directors was also announced based on the results of the election held online between 23-25 March 2022.

The AGM was followed by a Workshop, which was divided into 2 parallel sessions (chaired and moderated by our esteemed members), composed of presentations leading to discussions:

- 1) ETN Roadmap and pathways:
 - a. Gas Turbine capacity and supply chain to support the energy transition
 - b. Is hydrogen firing commercially attractive?
 - c. Opportunities for Gas Turbines in decentralised energy systems
- 2) Technology developments: priorities and milestones:
 - a. Gas Turbine cycle performance expectations in the energy transition
 - b. Next generation of combustion systems
 - c. Recovery of CO₂ from gas turbine flue gases

Presentations from the AGM and Workshop sessions are available on [our website](#) (login required).

ETN Activity Update 2021-2022

Prior to the AGM, ETN office prepared an Annual Activity Update, which is a report detailing ETN activities which took place since AGM 2021. This document can be downloaded [here](#) (login required). ■



Photo taken at ETN's AGM on 29 March 2022

New members

We warmly welcome teQServices (the Netherlands), Omiseal Solutions-Saint Gobain (Austria), Proenergy (USA) and Liburdi Turbine Services (Canada) who joined ETN.

[teQServices](#) specialise in maintenance, service, and overhauls of rotating equipment. They offer total care for gas turbines, steam turbines and compressors. Both incidental and long-term maintenance or interim inspections and complete overhauls, including reports. Irrespective of the equipment's size, type, and brand.



[Ominseal Solutions - Saint Gobain](#) is a global engineering leader with over 65 years



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of historical legacy, relentlessly dedicated to the design and manufacture of precision sealing and material solutions that protect critical applications in the most demanding environments and passionately driven to push Beyond the Boundaries of Possible®.

[PROENERGY](#) is a global peak-power solutions provider with operational experience on every continent. The company offers vertically integrated aeroderivative power services, including engineering, construction, operations, repair, maintenance, research, and true, turnkey peak-power facilities that include the complete balance of plant.

PROENERGY

[Liburdi Turbine Services](#) operates internationally offering engine component repairs for gas path engine components in blades, vanes, combustors, seals, shafts, and cases.



Liburdi's engineering & production groups offer innovative engineered solutions to allow OEM's, overhaul shops and end users to meet their operational life expectancy in EOH times and safely extend gas turbine component life. ■

ETN LM-2500 User Group Meeting



ETN's LM-2500 User Group Meeting will be held at TotalEnergies E&P facility in Aberdeen, Scotland, UK on 7-9 June 2022. Participation is open for all representatives of LM-2500 User companies.

Registrations

Representatives of LM-2500 User companies can now register through a dedicated [event website](#).

Programme

The three day event will include the following:

- User sessions: discussions among users on top-priority topics
- GE Aviation sessions: special session on latest developments & upgrades and technical discussions on high priority topics
- Technical sessions with selected Service Providers & Suppliers
- An exhibition area
- Networking dinners

To learn more about LM-2500 User Group meeting, please visit our [event website](#). ■

ASME Turbo Expo 2022

[ASME Turbo Expo 2022](#) will take place in Rotterdam, the Netherlands 13-17 June 2022. The Conference theme for this year is "Road Mapping the Future of Propulsion & Power".

ETN's Managing Director Christer Björkqvist will be the Executive Conference Chair and will co-moderate the keynote session "Road-Mapping the Future of Propulsion and Power" to be held on 13 June 2022. Pedro Lopez Estebarez, ETN President of the Board and COO Uniper will be one of the speakers at the keynote session stressing the importance of a wide cooperation and showcasing Uniper's dedication to empowering the energy evolution by becoming carbon-neutral and by offering sustainable energy solutions. ■



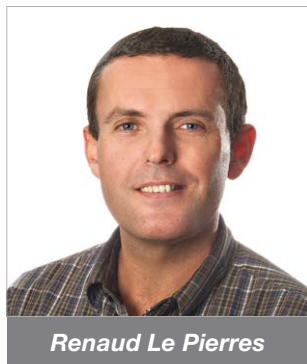
Educational courses

ETN is collecting information about technical gas turbine courses given by our members, to promote and share the knowledge and experience of our community. You can find a list of scheduled courses [here](#). If your organisation would like to list some courses on our website, please [contact us](#) for more details. ■

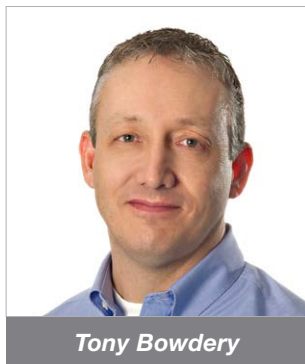


Interview with CO2OLHEAT project partner Heatric

Renaud Le Pierres, Business Development Engineer and
Tony Bowdery, Regional Manager – USA



Renaud Le Pierres



Tony Bowdery

CO2OLHEAT is an EU H2020 funded project demonstrated at a high Technology Readiness Level (TRL 7) in a CEMEX cement plant in Prachovice, Czech Republic. This project is broken down into several work packages covering:

- *process design and control*
- *main equipment design and supply*
- *integration in CEMEX Prachovice plant*
- *replication of CO2OLHEAT in other industries*
- *dissemination, communication and exploitation of CO2OLHEAT activities and results*

As part of dissemination activities, the consortium partners all provide their support and HEATRIC recently worked with several project partners, on a technical poster for presentation at the 7th sCO₂ Symposium, held in San Antonio, Texas (between 21 to 24 February 2022), a major event dedicated to supercritical carbon dioxide (sCO₂) systems.

What is HEATRIC's role in the project?

Tony: HEATRIC main activities within CO2OLHEAT project are associated with Work Package 4 (Heat Exchangers) together with BOSAL (red. another consortium partner), where HEATRIC is



Chemically etched plates used in PCHEs

designing and supplying the CO2OLHEAT Recuperator heat exchanger to be used in the CEMEX CO2OLHEAT plant, as well as a representative test unit to be used by BRUNEL (red. another consortium partner) to validate the control methodology to operate the CO2OLHEAT plant.

HEATRIC also provides support to: Work Package 1 to optimise the process and make the best use of the benefits of the Printed Circuit Heat Exchangers (PCHEs) used as Recuperator heat exchangers; Work Package 5 for the control system of the CO2OLHEAT plant; and Work Package 6 for the integration of the PCHE in the CO2OLHEAT Plant inside the Prachovice CEMEX site.

Renaud: The purpose of this Recuperator heat exchanger is to improve the over cycle efficiency in the CO2OLHEAT closed power conversion loop by pre-heating the cold sCO₂ fluid, coming out of the Baker Hughes Compressor, before reaching the Primary Heat Exchanger from BOSAL by using the heat from the hot sCO₂ fluid, coming from the Siemens Energy power turbine, prior to reaching the CO2OLHEAT Cooler from BOSAL.

HEATRIC is using its Printed Circuit Heat Exchanger (PCHE) which is a compact heat exchanger providing very high thermal efficiency and mechanical integrity in a much smaller size compared to other heat exchangers; it has been used in at least 20 different sCO₂ projects be it test loops, demonstration plants and commercial plants and each PCHE has been designed as a bespoke unit to ensure the optimum balance between size and overall system efficiency.

What was the purpose of the new CO2OLHEAT technical poster that HEATRIC initiated for 7th sCO₂ Symposium?

Renaud: HEATRIC, being part of the sCO₂ Symposium committee, requested an opportunity to provide a technical poster to illustrate CO2OLHEAT project. Poster's aim was to show the goals of each work package and highlight the technical development in each part of the project plus the complexity of designing, manufacturing, installing, and operating a first of a kind sCO₂ waste heat recovery system in an existing plant built in the 70s before waste heat recovery was ever considered.

CO2OLHEAT organised a dedicated team including representatives from SimeROM, Baker Hughes, EDF, Bosal, Siemens Energy, HEATRIC, ENEA, Politecnico di Milano, Brunel University London and ETN Global as main contributors on behalf of the consortium members.

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After several weeks of work, a technical poster was completed and made available [here](#) on CO2OLHEAT website. A support document was also collated to provide further detail, which can be found [here](#).

What was the feedback on the CO2OLHEAT technical poster and how would you describe the impact of the project for the future?

Tony: Feedback in San Antonio, Texas was very positive with a number of attendees observing some parallels with the US Department of Energy STEP project (Supercritical Transformational Electric Power) currently under construction at Southwest Research Institute (SwRI) located very close to the Symposium.

Both projects aim at CO₂ emissions reduction; however, at the same time, we must be pragmatic how we do so. Many industrial plants necessary to global economies were built at times when emissions were of little concern. It would take several years to build new European plants with reduced emissions and at great cost, having a negative impact on how they compete with plants located outside Europe with far less stringent emission policies.



As such, emission reduction systems which can be retrofitted to existing plants will be essential in ensuring the minimum disruption to plant production, and therefore companies' revenues, while minimising current and future CO₂ taxation.

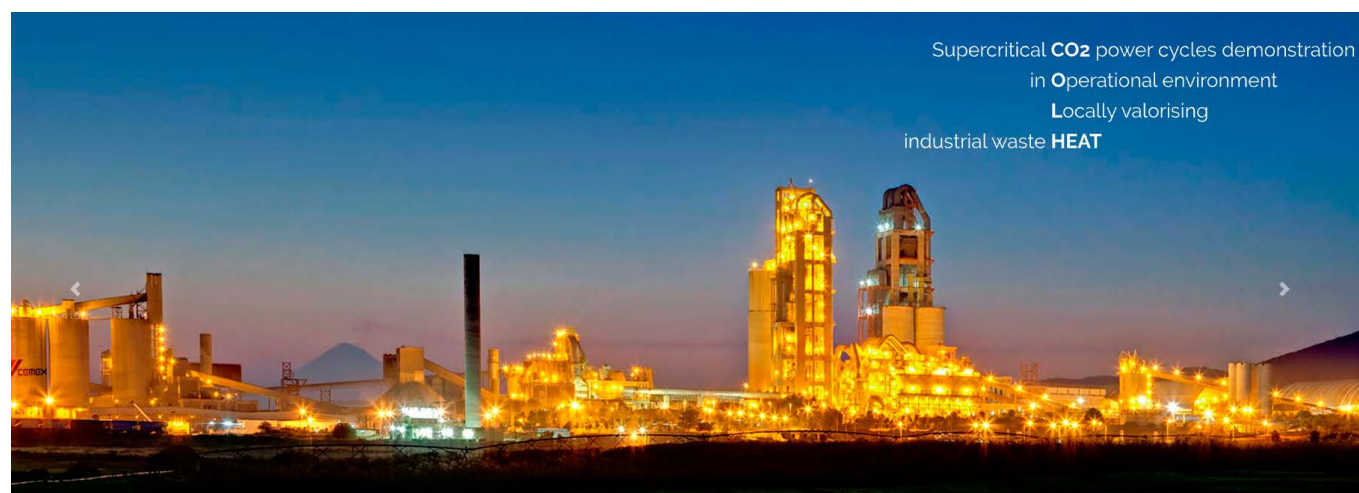
CO2OLHEAT will in that respect show a great benefit of sCO₂ systems which can achieve a very high efficiency in a compact space envelope thus facilitating retrofits of existing static equipment. ■



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101022831

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Interview with FLEXnCONFU project partner RINA Consulting

Alessandra Cuneo, Project Coordinator



Alessandra Cuneo

The FLEXnCONFU project started in April 2020. The main goal of FLEXnCONFU is to develop and demonstrate an innovative, economically viable and replicable power-to-X-to-power solution in a real combined cycle (CC) plant that enables the operation and design of an integrated power plant layout to untap CC plants' flexibility. As the project reached 2 years, we interviewed Alessandra Cuneo, FLEXnCONFU Project Coordinator, to learn more about the achieved progress

It has been exactly 2 years since FLEXnCONFU project began. What are the main achievements since the commencement of the project in April 2020?

We have just celebrated a two-year anniversary and I must say that a lot has been achieved so far by the whole consortium. The focus has been on the analysis of potential layouts of Power-to-Power (P2P) systems to be connected to the existing and new power plant. The layouts have been analysed from a techno-economic point of view considering potential barriers and how to overcome them. Based on the findings, detailed layouts have been defined specifically for the Power-to-Hydrogen (P2H) system to be connected to EDPP Ribatejo Power Plant (demo site) as well as for the Power-to-Ammonia (P2A) system to be connected to the mGT (demo site) already installed at Savona laboratory of the University of Genoa.

At both demo sites, the Piping & Instrumentation diagram (P&ID) of the overall system has been defined including all aspects related to the health and safety analysis and proper procedures to safely operate them. In parallel, dynamic models have been developed based on Reduced Order Model (ROM) to simulate the transient behaviour of the systems.

The impact of FLEXnCONFU integration on power plant performance has been analysed together with preliminary evaluation of combustion processes using different blends of H₂/NH₃/NG through Computational Fluids Dynamics (CFD) analysis and experimental tests.

Consortium partners also conducted a study resulting in a report on EU electrical markets to see the potential viability of FLEXnCONFU solutions in selected EU countries (will be available on [project website](#) shortly).

Finally, we have been successfully disseminating and communicating about FLEXnCONFU project and potential solutions it could provide on a global scale by continuously updating our [project website](#), sending out a newsletter to subscribers as well as posting on social media, being featured in an article by an online [Power Magazine](#), participating at EU-funded workshops (e.g. [EU Sustainable Energy Week](#)), international conferences (e.g. [ASME Turbo Expo](#) and [International Gas Turbine Conference](#)) and other relevant events.

What are the specific barriers and challenges that the project had to address during the first two years?

The main challenges that we faced can be summarised under three themes:

- **Technical:** the integration of non-conventional fuels such as hydrogen and/or ammonia in existing power plants is not always easy due to the local constraints. In particular, the compatibility of the plant with the use of H₂/NH₃, the Balance of Plant (BOP) assessment and the interface management were the three main aspects that posed major challenges in the definition of Process Flow Diagram (PFD) and BOP integration.
- **Site and Safety:** initially the layout definition focused mainly on space and less on security and safety for GT protection and power plant integration. This requirement was incorporated and addressed to ensure safe operation of the system.
- **Regulatory:** the license process for EDPP plant was complex as the installation of such innovative systems had to comply with environmental and safety requirements through adequate permits.

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Considering the evolving situation of the last months with the war in Ukraine and unprecedented high natural gas prices do you think that FLEXnCONFU solutions are becoming even more relevant for the gas turbine industry?

Yes, absolutely. The FLEXnCONFU solutions aim to not only decrease the environmental footprint of power plants in Europe, but also to decrease its dependency on the natural gas. Studying innovative solutions that could partially or totally replace the use of natural gas in the gas turbine industry towards the use of carbon-neutral fuels provides a new opportunity for power plants to maintain their role in the energy production in Europe, also in a more environmental and economic way. The fact that hydrogen and ammonia are directly produced by local power plants meets this objective.

What will be the next steps in the coming months and in 2023?

In the coming months, the activities within the project will be focused on the following:

- **Detailed engineering, construction, and installation:** now that the layout has been defined for both P2H and P2A system, the detailed engineering is currently on-going in terms of the construction of the two systems and the installation at EDPP and UNIGE (University of Genoa) plants. The objective is to have everything installed by March 2023 to start the demonstration campaign in April. Preliminary



tests of different components will be performed by Cummins and ICI Caldaie in their laboratories before the deployment at demo level.

- **Supporting activities for the demo campaign:** to ensure the two systems are operational, several activities will be taking place during the next months. Combustion tests of H₂ and NH₃ supported by CFD simulations will continue at CU (Cardiff University) laboratory and various control strategies supported by dynamic simulations of the two systems will be developed.
- **Transversal activities:** now that the design is finalised and preliminary results are available from a techno-economic and dynamic point of view, partners will start to evaluate the impact of FLEXnCONFU from an environmental point of view, also considering the impact of the combustion processes, as well as replication studies and scale-up of the systems. All these activities, will continue until the end of the project, expected in early 2024, leveraging results from the demonstration campaign. ■



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 884157

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Ribatejo Power Plant, EDP Gestão da Produção de Energia

Interview with Robinson project partner Aurelia Turbines

Tony Hynes, Commercial Director



Tony Hynes

ROBINSON project aims at developing new energy solutions for Eigerøy Island in Norway and building business models to replicate its concept to the Western Islands (UK) and Crete (Greece). To do so ROBINSON consortium created the Islands Energy Forum at the beginning of the project to initiate a dialogue with other islands to be able to share experience and expertise on decarbonisation and technology challenges.

What is the role of the CHP unit in the project and how will it work?

The CHP is the central system in the production of electrical and heat energy utilising the available gas fuels, hydrogen, Gasifier gas, biogas and natural gas.

Hydrogen will be produced by a commercially available electrolyser using electrical energy partly made available by the wind turbine component of the Project.

The gasifier will be a commercially available technology which will gasify wood and waste products available on the island to produce combustible fuel gas.

The biogas is available from the site's biogas digester. The digester is fed with waste by-products of the host company process (fish processing). The biogas will be modified by the Anaerobic Digestion system assisted by a Bio Electrochemical unit (AD+BES) to produce a natural gas analogue which will be mixed as part of the turbine fuel.



Aurelia® A400 Gas Turbine

The mixing station will mix the fuels based on availability to such a composition that is suitable for the Aurelia A400 gas turbine generator. The current expectation is that the gasifier gas and modified biogas will be used to 100% availability and that this will be topped up by use of hydrogen and natural gas.

The electrical energy produced by the Aurelia A400 will be available to the host process through the existing electrical distribution network to offset current utility electrical import.

The heat available from the Aurelia A400 will be utilised where possible for heating processes within the host company process.

What are the main challenges related to the integration of a renewable fuel-based CHP unit?

From our perspective, fuel is a significant challenge. In particular, the definition and the quality of the composition of the fuel available from each of the gas producing technologies.

More specifically, the challenge is the fuel system management from the three different fuel sources and then to supply fuel according to combustor's specification. To tackle this, we have developed a tool that estimates the maximum flow rates of each fuel to maintain the fuel gas delivered to the A400 within the required boundary limits and therefore the capacity of the mixing system.

Is ROBINSON project opening new opportunities for the gas turbine community?

Robinson project is key to demonstrating the necessity of fuel flexible combustion systems to make good use of locally available resources and manage waste processes more effectively.

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Fuel flexible applications for small gas turbine systems are significant in future growth of the distributed energy sector. As such, Robinson is a model which can be replicated throughout the global market where islands are facing restrictions on energy supply or seeking more sustainable solutions.

What will be the next steps in the coming months and in 2023?

We have a very busy and exciting phase ahead. This is when the coordination and cooperation of the eighteen partners will move into a physical phase. Shortly, we will be finalising the detailed site engineering and installation design. Then we will move into the manufacturing of the A400 and procurement of plant equipment, followed by installation planning and implementation scheduling. Then delivery from Finland to Norway in early 2023, followed by testing and integration and handover of the energy system to the host. In brief, we are moving from planning to delivery and operation!



Any last comments?

When we joined this large consortium, it was difficult to anticipate how so many disparate parties could effectively move in the same direction. So far, Robinson has been very well managed and successively overcome the challenges of the pandemic and the stretch on resources and logistics: long may it continue. ■



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957752

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REPowerEU – Joint European action for more affordable, secure and sustainable energy

In 2021, the EU imported more than 40% of its total gas consumption, 27% of oil imports and 46% of coal imports from Russia. On 8 March 2022, in light of Russia's invasion to Ukraine, the Commission published its [REPowerEU plan](#), outlining measures to drastically reduce Russian gas imports from its 2021 level of 155 bcm within a year (by nearly 2/3) – and reach complete independence from Russian fossil fuels well before the end of the decade. The key elements in this plan are:

- diversifying supplies (via higher LNG and pipeline imports from non-Russian suppliers)
- reducing demand (via gas storage)
- ramping up the production of green energy in the EU (accelerating the European Green Deal)

On 23 March 2022, EC presented a legislative proposal, dealing mainly with the gas storage obligations. At the same

time, EC declared itself ready to create a Task Force on common gas purchases at EU level. The first meeting of the EU Energy Purchase Platform was held on 7 April 2022. More information from the meeting can be found [here](#).

Building upon the outlined REPowerEU concept, the EC is expected to propose a concrete action plan in May 2022. ■



1. Diversify supply and increase renewable gases (hydrogen, syngas, methan and biofuels)

- New LNG and pipelines imports in 12 months – **60 bcm**
- Double biomethane production – from **18 bcm to 35 bcm by 2030**
- Increase production and import of renewable hydrogen (20 millions tonnes) – **50 bcm**
- **Replace 20 bcm of imported gas already in 2022** (15 bcm from US)

2. Accelerate clean energy transition

- Doubling **photovoltaic and wind capacity by 2025**
- Speed up permitting procedures for on- and offshore wind and large-scale solar projects
- **Double the installation rate of heat pumps** over the next 5 years.
- A new Temporary Crisis Framework for State aid to mitigate higher energy prices

ETN Global summary of RePowerEU plans

THE LIFE OF THE GT COMMUNITY

Upcoming meetings and events

Meeting/Event	Date	Location
ETN Project Board meeting	04 May 2022	Virtual
ETN Board meeting	20 May 2022	Virtual
ETN LM2500 User Group Meeting	08-09 June	Aberdeen, Scotland, UK
ASME Turbo Expo 2022*	13-17 June 2022	Rotterdam, the Netherlands
High-Level User Meeting	October 2022	Tbc
October Workshop	12-13 October 2022	Berlin, Germany

* ETN members are entitled to a discounted registration fee | ** Event only for ETN members

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ETN at a glance

Download the [three-pager](#) and learn more about ETN's vision.



Are you interested to become an ETN member?

Download the [one-pager](#) showcasing the benefits of being part of ETN's global community.



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