

# 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.

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Christer Björkqvist  
Managing Director

## 20 years of Innovation, and Collaboration Towards Net-Zero Solutions

This year promises to be one of significant growth and innovation for ETN, marked by increased global engagement and the launch of exciting projects tailored to our members' interests.

In line with our commitment to expanding our global presence and influence, we officially changed in 2023 our name to the Energy & Turbomachinery Network, while retaining our ETN abbreviation. This new name reflects our evolving identity and emphasises our dedication to foster a wide-ranging and globally oriented cooperation.

I am thrilled to share that this year, we will be celebrating our 20<sup>th</sup> Annual General Meeting on 20-21 March in the beautiful city of Leiden, just outside Amsterdam. This milestone event will provide an opportunity to reflect on our past achievements while focusing on the roadmap ahead, with the objective of making productive advances in our agreed priority areas. Moreover, we will be offering complimentary courses in the afternoon ahead of our AGM, providing valuable insights to the impact of changing operating conditions and fuels.

As always, there will be plenty networking opportunities during lunch and coffee breaks at our expo and in the evenings during dinners. On 19 March there will be dedicated working dinners, and on 20 March we will host our gala dinner. With over 100 registrations already secured, we anticipate reaching our target of 160 participants soon. Be sure to secure your place if you haven't already!

In anticipation of this milestone event, I recently revisited my presentation from our inaugural AGM in 2005, titled "Towards Near Zero Emissions". While the topics remain consistent, it is remarkable to witness the progress we have made in enhancing gas turbine efficiency and environmental sustainability through advancements in fuel flexibility, material repair technology, and condition monitoring. However, it's essential to acknowledge that these areas remain key priorities, with additional development opportunities and milestones to reach.

In recent ETN engagements in key markets outside Europe, including the US, Canada, and Japan, I'm pleased to report a collective push for further technological advancements in line with the latest COP 28 agreements. Despite market variations, the industry stands united in our commitment to developing a diverse portfolio of solutions that cater for distinct market demands, all in pursuit of our shared goal of achieving Net-Zero emissions.

While significant technological progress has been made, accelerating future developments, including demonstration and implementation of these solutions, requires collaborative efforts to strengthen market demand from the user community. Within ETN, we are diligently working to establish comprehensive requirements with timelines from the gas turbine user communities to incentivise crucial investments. However, to accelerate tangible and timely progress towards our sustainability goals, further support from policymakers will be required to facilitate the transition from planned investments to Final Investment Decisions.

In Europe, urgent reforms are necessary to incorporate market mechanisms that prioritise dispatchable power generation in alignment with sustainable objectives, particularly with the significant planned increase of Variable Renewable Energy (VRE) to be integrated in the energy mix. Emphasising high efficiency and low-emission solutions, coupled with incentives for essential investments in dispatchable back-up capacity, is crucial to ensuring the resilience and security of future energy systems not only in Europe but globally.

As we navigate the opportunities and challenges ahead, I invite you to join us in this transformative journey in shaping the future of energy and turbomachinery.

Collaboratively, we can achieve tangible advancements that offer resilient solutions for consistent carbon reduction, towards our goal of net-zero solutions.

## ETN officially becomes Energy & Turbomachinery Network

ETN, formerly known as European Turbine Network, is thrilled to announce a transformative milestone in our role as a key player in driving the decarbonisation of the energy and turbomachinery sector. We have officially changed our name to Energy & Turbomachinery Network.

The decision to officially rebrand was unanimously approved at ETN's 19<sup>th</sup> Annual General Meeting held in London on 28 March 2023, solidifying our commitment to a more inclusive and globally oriented identity.

This strategic rebranding initiative comes in response to our expanding international presence and our dedication to fostering closer collaboration among the global gas turbine user community. The move also aligns with the increasing global commitment towards achieving net-zero emissions goals. With members spanning users, original equipment manufacturers, consultancies, service providers (including insurance providers), research centres, and universities, the Energy & Turbomachinery Network aims to facilitate a coordinated approach towards a sustainable energy future.

Pedro Lopez, President of ETN Global and COO of Uniper, expressed his enthusiasm for the evolution, emphasising that the name change reflects the diverse and global nature of the community. He stated, "We are excited about this

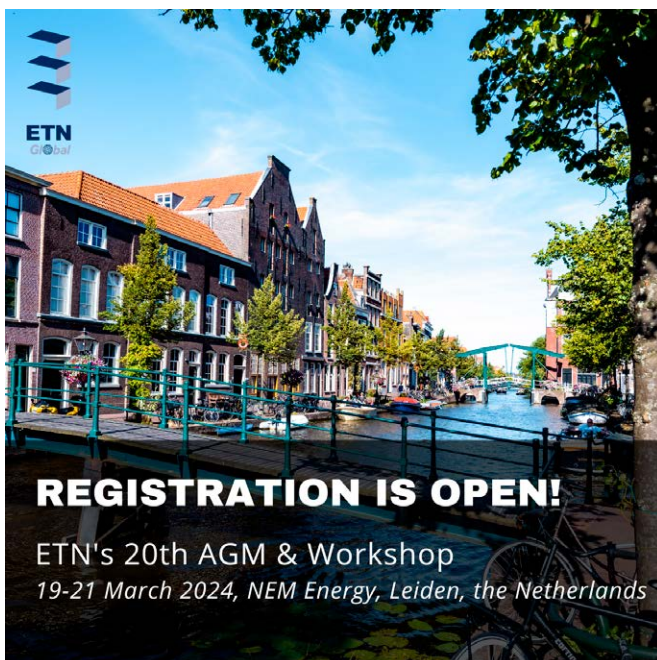
transformation, believing that the name change more accurately reflects the diverse and global nature of our community. This rebranding is not just a name change; it's a strategic move towards a more collaborative and coordinated future for the benefit of our members."

ETN is grateful for the steadfast support from our members, partners, and the broader industry as we embark on this evolutionary journey. Anticipating deeper collaboration and substantial growth, we look forward to advancing under our new name, symbolising a renewed commitment to driving sustainable change on a global scale.

Read the full press release on ETN's [news webpage](#). ■



## ETN's 20<sup>th</sup> Annual General Meeting & Workshop: Registration is open!



ETN's Annual General Meeting (AGM) and Workshop titled "Accelerating turbomachinery pathways to net-zero" will take place on 19-21 March 2024 in the city of Leiden, the Netherlands. We will be generously hosted by our member NEM Energy. Registration is open, and we invite all our members to join us at this remarkable event where will be celebrating our 20-year anniversary since the first AGM, which took place in 2005.

### About the event

ETN's Annual General Meeting (AGM) and Workshop brings together representatives from the whole gas turbine (GT) community. Our event does not only provide an opportunity to receive the annual activities' update and planned activities for 2024, but also creates a perfect setting to hear about the latest gas turbine technology developments and trends; to find out the needs and requirements from users' perspective; and to explore, discuss and exchange ideas with gas turbine experts.

*continued on page 3*



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### Programme

ETN's event will take place over two and a half days on 19-21 March. The programme looks as follows, providing ample networking opportunities during the breaks and at the expo area:

- 19 March: Courses (13:45-18:00 CET)
- 20 March: AGM (11:00-17:30 CET)
- 21 March: Workshop with two parallel sessions (08:45-18:00 CET)

### Registration

Registration is now open and all our members are invited to register via our event webpage: [ETN's 20<sup>th</sup> Annual General Meeting \(AGM\) and Workshop](#).

### Exhibition opportunities

Our annual event provides an excellent opportunity to increase your visibility and to display your latest technology development and offered services to the entire gas turbine community. It is also a great chance to explore future partnerships and cooperation in line with the market trends.

Our host and main sponsor for the event is our valued member:



Our other sponsors and exhibitors for this event are:



**Join us** at our Annual General Meeting and receive our annual activity updates, discuss how we can accelerate turbomachinery pathways to net-zero and most importantly come **to celebrate our 20<sup>th</sup> anniversary** with us.

For registration and more information, visit our [20<sup>th</sup> AGM & Workshop webpage](#).

Leiden | @JaySi | shutterstock.com



## New members

Since our last quarterly newsletter, the following new members have joined ETN, and we bid them a warm welcome:



Cheniere provides secure, reliable, and environmentally conscious energy solutions on a global scale.

The company's mission revolves around contributing to the reduction of carbon emissions while meeting essential energy needs for residential and industrial purposes.

As the largest producer of liquefied natural gas (LNG) in the United States and the second-largest LNG operator globally, Cheniere has successfully expanded its LNG presence to numerous markets across five continents.



Vicosol enhances the availability, reliability, and efficiency for operators of LM

engines. The company places a primary emphasis on delivering premium services across various domains, including Control Systems, Engineering, Maintenance, Field Service, Parts, Repair, Training, and Support. The company takes pride in its streamlined operational approach and expeditious turnaround times, ensuring prompt and effective support for its clientele within turbomachinery.



Svensk Kraftreserv, a wholly owned subsidiary of Svenska kraftnät, assumes responsibility for the operation

and management of gas turbine facilities essential for Svenska kraftnät's operational requirements. The company is strategically aligned with the objective of furnishing reserve capacity through its gas turbine power plant, emphasising a commitment to high availability.



Established in 1906, Politecnico di Torino, is a leading European institution for engineering and architecture,

emphasising industry collaboration. The Department of Energy (DENERG) focuses on advancing power, energy, and sustainable development, managing vital research and technology transfer. Specialising in numerical simulations of turbomachinery flows, their research group employs an in-house finite-volume solver and a shared high-performance computing cluster for advanced analysis.



For over 50 years, Petrotech has been a leader in providing bespoke retrofit control system solutions. Operating

globally, the company specialises in turnkey packages, encompassing design, engineering, manufacturing, and commissioning. Petrotech's solutions cater to diverse platforms, including Gas, Hydro, and Steam turbines, generators, engines, compressors, and more. With over 3,000 operational systems worldwide, the company delivers comprehensive services for turbo/rotating machinery control systems, ensuring seamless integration and top-notch customer support.



The University of Southampton, renowned for excellence in engineering, hosts

the Department of Aeronautics and Astronautics, a global leader in aerospace education and research. From groundbreaking research to innovative teaching methods, the department nurtures future leaders in the aerospace industry, contributing significantly to technological progress and exploration.



With nearly two centuries of expertise, FM Global stands as a prominent commercial property insurance company, specialising in property loss prevention, having already

insured over 1000 gas turbines globally (both frame and aeroderivative designs). Backed by engineering, data, and extensive research, FM Global focuses on building future business resilience.



Established in the early '90s, Metalvar New is a pioneer in metal surface treatment and cold ceramic/metallic coatings in Italy. With a focus on innovation, the company specialises in Plasma/

HVOF technology, and excels in Thermal Barrier Coatings (TBC). It is recognized as a leader in thermal spray coatings, offering top-notch solutions to enhance industrial component performance, efficiency, and thermal protection with a commitment to innovation and excellence.

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## New members - continued from page 4



30 years of experience, the company designs, develops, and supplies test facilities and ground support equipment globally to military & civilian markets. Dedicated to providing state-of-the-art products and services, Aerotest focuses on expanding its product range through bespoke solutions. Company's services include the design and development of reusable preservation systems, gas turbine engine & component test facilities, and upgrades of gas turbine engine test facilities.

Aerotest specialises in creative solutions for complex engineering projects. With over



Founded in Germany in 1978, DEKOMTE is globally renowned for innovative design and high-quality products, serving power stations world-wide. With in-house engineering and manufacturing, the company prioritises sophisticated solutions for end-user life cycle value over capital cost. Their highly flexible joints, ideal for high cycling or varying operations, offer extended life and robust warranties, setting them apart in the market.

Founded in Germany in 1978, DEKOMTE is globally renowned for innovative design and high-quality products, serving power stations world-wide. With in-



Cr8las Group excels in four specialized domains: metal works, field services, technical personnel, and rotating equipment. Metal Works delivers bespoke welding and assembly solutions. Field Services specialises in certified welding, technical maintenance, and new construction. Technical Personnel addresses the scarcity of technical professionals. And Rotating Equipment manages the maintenance and overhaul of turbines. ■

## Closing the gap: PROENERGY's PE6000 turbine revolutionises dispatchable power generation

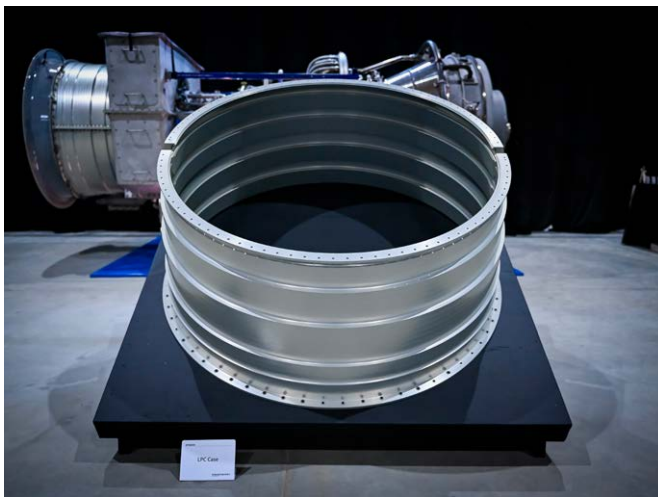


Figure 1: PE6000 with LPC case.

As the global power generation sector decarbonises and expands renewable installations, a corresponding and growing need for dispatchable generation is required. In Europe alone, McKinsey & Company foresees a 116 GW gap in dispatchable power by 2035, assuming that no new capacity is built.

PROENERGY embarked on a path to overcome worldwide supply chain constraints and fulfil this expanding need. The company's efforts led to the development of the PE6000 turbine: a new aeroderivative turbine for peaking power applications. The PE6000 can quickly close the gap between power supply and demand that often occurs during severe weather, solar ramp off, and days with low or limited renewable production. In fact, one 48-MW turbine can provide firm power generation for more than 40,000\* American homes.

Each PE6000 begins by upcycling an engine core from the CF6-80C2, found in aircraft including the Boeing 747. PROENERGY overhauls that core and integrates it with aeroderivative parts — manufactured through in-house capabilities at the company's own campus in Sedalia, Missouri — to create a new machine.

"Our in-house engine and repair expertise was a critical enabler of the PE6000 program," says Rob Andrews, PROENERGY SVP Operations. "We developed other key areas of expertise in system and component design, materials engineering, and manufacturing excellence to progress our R&D program both internally and in collaboration with key partners and suppliers.

\* Based on EIA data available [here](#).

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The result is a product manufactured proudly with every new part to PROENERGY design and specification.”

The concept of matching a flight engine core with aeroderivative parts was born and executed through a collaboration between a major European utility and PROENERGY. That engine — which used market available aeroderivative components — now has more than 180 starts and 8,000 run hours.

PROENERGY continued its journey with a \$115-million investment in its PE6000 programme — to include R&D, advanced manufacturing, and infrastructure — and has manufactured two PE6000 turbines to date. One unit, installed in a WattBridge generating facility in Houston, has more than 100 starts and 750 hours of runtime. The second unit is now ready for testing. A further six units are scheduled for validation in WattBridge facilities. These first eight units alone can provide grid-firming capability to more than 320,000 American homes, and further production will support reliable power generation for millions.



**Jeff Canon,**  
**PROENERGY**  
**President & CEO**

“We aim to deliver exactly what the world needs right now: low-cost, dispatchable peaking power,” says Jeff Canon, PROENERGY President and CEO. “Our company was founded on finding a better way; for us, this meant giving flight engines new life and becoming an OEM for aeroderivative turbines.”

For more information about PROENERGY’s PE6000, visit the [company’s website](#). ■

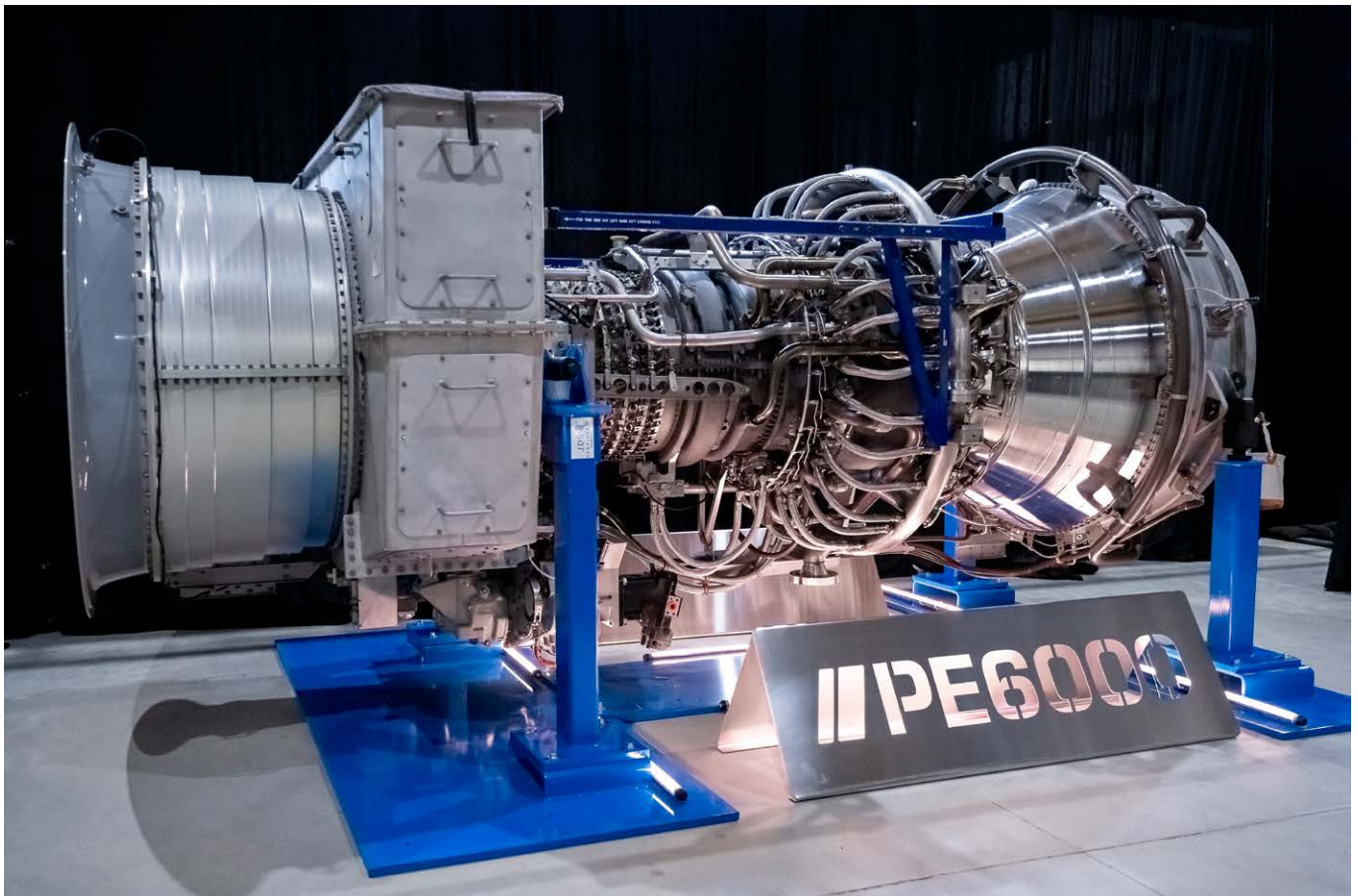


Figure 2: PROENERGY assembles a complete PE6000 aeroderivative turbine at its Sedalia campus using components made by the company.

# ETN's High-Level User Meeting: key messages from the user community

ETN's annual High-Level User Meeting (HLUM) 2023 titled "Efficient, flexible and low carbon pathways towards net-zero solutions" was held on 09 October 2023 in Brussels, Belgium; a day prior to ETN's International Gas Turbine Conference.

At the heart of the discussions during ETN's HLUM were five key messages:

## 1. Flexibility in the face of variability:

As the world transitions towards a greater reliance on renewable energy sources, the need for dispatchable energy becomes increasingly apparent. With the intermittent nature of renewables posing challenges to grid stability, gas turbines emerge as the cornerstone in providing optimal flexibility. Their ability to swiftly adjust output in response to fluctuating demand positions them as indispensable assets in this regard.

## 2. Decarbonisation as the main goal:

Amidst the evolving energy landscape, decarbonisation stands as the paramount objective for the gas turbine users. Stakeholders unanimously underscored the imperative of reducing carbon emissions, with rigorous efforts underway to draft comprehensive development and deployment plans. By embracing innovative technologies and collaborative frameworks, the gas turbine community remains steadfast in its commitment to driving meaningful reductions in carbon footprint and working towards achieving the net-zero goals.

## 3. Focussing on low-carbon solutions:

In the pursuit of decarbonisation, hydrogen, and CC(U)S (Carbon Capture, Utilization, and Storage) solutions emerge as frontrunners, alongside biofuels, where applicable. These low-carbon alternatives offer promising avenues for mitigating emissions across

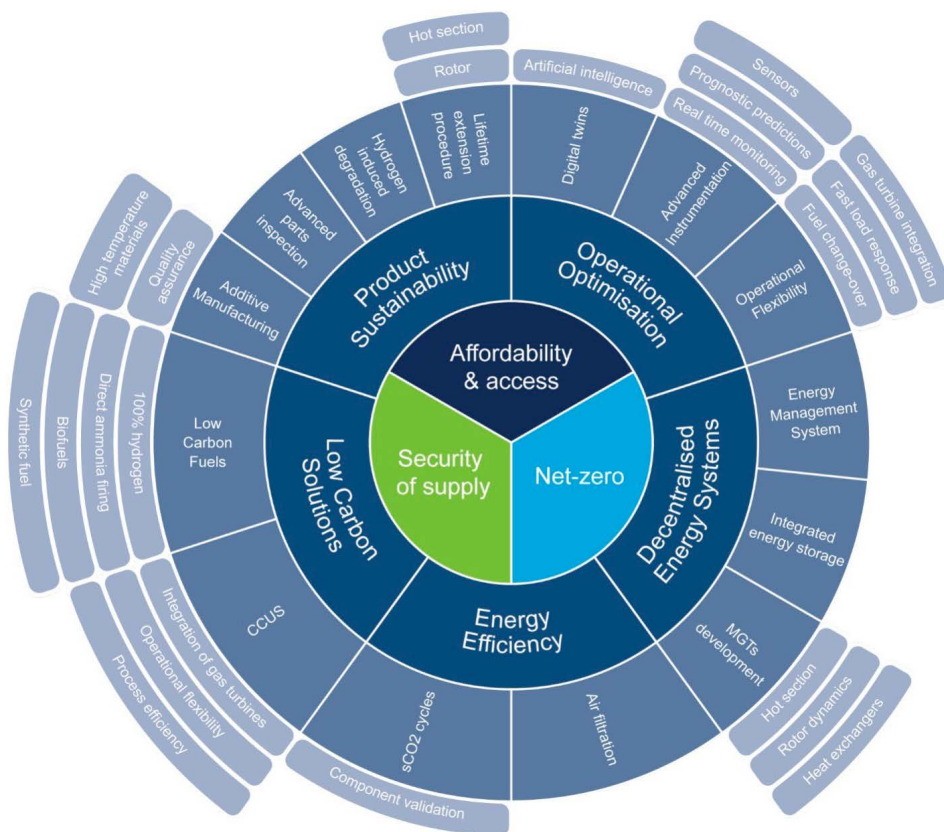


Figure 3: Technology transition pathways

diverse sectors, underscoring the importance of embracing a multi-faceted approach towards sustainability.

## 4. Reforming the energy market:

A paradigm shift is called for in the energy market, one that aligns with a climate-centric approach. Participants advocated for the integration of market mechanisms that prioritise high efficiency and low-emission solutions. By incentivising investments in dispatchable back-up and capacity, such reforms hold the potential to catalyse transformative change while fostering resilience in the face of evolving energy market, especially across the EU.

## 5. Enhancing operational efficiency:

Maximising the operational efficiency of existing assets emerged as a pressing priority. Participants also emphasised

the role of automation and digitalisation as indispensable tools in optimising performance and driving productivity gains.

Although the user community sees a great deal of progress made towards achieving net-zero goals, there is still a great deal of change that needs to happen, especially in terms of the energy market reform needed from the policy makers' side and focus on enhancing operational efficiency of current assets, which should be addressed by the OEMs.

Building upon the rich insights gathered from the High-Level User Meeting, ETN has collected the combined wisdom of its user community into a visually captivating graphic. Figure 3 serves as a compass, charting the Technology Transition Pathways that align with ETN's core objectives and the energy trilemma: Energy Security, Net-Zero Goals, and Energy Affordability. ■



## ETN's 11<sup>th</sup> International Gas Turbine Conference: proceedings available

ETN's 11<sup>th</sup> International Gas Turbine Conference (IGTC), titled "Dispatchable Technology & Innovations for a Carbon-Neutral Society", was successfully held on 10-11 October 2023 at Tangla hotel in Brussels, Belgium. Events' proceedings are available for the attendees who received the details via email.

ETN's prestigious event gathered over 160 participants from industry leaders to policymakers and innovators, and included five keynote sessions, six technical sessions, a large exhibition, and plenty of networking opportunities. Together the participants explored net-zero power and heat pathways, engaged in panel sessions, and delved into sustainable solutions for the energy trilemma.

Presentations and lively discussions among experts from around the globe highlighted the gas turbine's dexterity as an optimal solution for bridging the capacity gap as the demand for dispatchable energy increases due to the introduction of more variable renewable energy into the network. With the ability to produce dispatchable energy when variable renewable sources like wind and solar are unavailable, coupled with its flexibility and capacity to run on low-carbon fuels, gas turbine technology emerged as a key player in the production of carbon-neutral energy.

A portfolio of carbon-neutral solutions took centre stage, driven by renewable fuels, particularly hydrogen and hydrogen storage, as well as biofuels, such as ammonia; complemented by Carbon Capture Utilisation and Storage (CCUS) solutions. The industry recognized the importance of integrating these solutions with other technologies like pumped hydropower storage (PHS), compressed air energy storage (CAES), and batteries, wherever suitable.

While the conference predominantly celebrated the industry's progress, a few considerations were raised. These included the need for the development of a carbon-neutral dispatchable energy strategy at the EU level. Discussions highlighted the importance of technology inclusion in the mix, supportive regu-



lations, financial incentives, and backing for demonstrations, emphasising integrated solutions with flexible dispatchable energy based on carbon-neutral fuels. Such EU-level support was seen as a catalyst for improving investment conditions and enhancing global competitiveness.

Overall, the IGTC served as a dynamic forum where industry leaders collectively charted a course toward a cleaner and more sustainable energy future. The outcomes of the conference underscore the commitment of the gas turbine community to play a pivotal role in achieving global net-zero targets.

ETN would like to extend our gratitude once again to the event's "Net-zero silver sponsors" (MTU Power, NEM Energy and Solar Turbines); "Exhibitors" (Ansaldo Energia, Holland-Controls, EMW filtertechnik, FWMarsh, MD&A and Score Group); and "Media partners" (Flex4H<sub>2</sub>, FlexnConfu, Robinson, CO<sub>2</sub>OLHEAT, ASTERIX-CAESar and The Energy Industry Times). Our gratitude also goes out to the Conference Advisory Board, Chairs and Moderators for their hard work and valuable contributions.

Presentations and technical papers are available for the IGTC-23 attendees who have received the access details via email.



Figure 4: IGTC-23 attendees, 11 October, Tangla hotel, Brussels, Belgium



## ETN publishes 2023 Edition of the R&D Recommendation report

ETN released R&D Recommendation report in conjunction with the 11<sup>th</sup> International Gas Turbine Conference in October 2023. It is a must-read publication underlining the necessary R&D efforts for the gas turbine sector in the future. The report is a living document and is revised on a biennial basis.

The purpose of the R&D Recommendation report is to summarise recommendations for R&D topics based on the user community's needs and requirements, energy policy targets and the transformative potential of gas turbine solutions.

All the topics presented in the report are addressed within the power generation, oil & gas and industry markets, the business segments where ETN members are active in. It considers areas related to integrating turbomachinery into new energy systems, advancing the state-of-the-art of component technologies and adapting to future emissions regulations and other regulatory frameworks. All the subjects addressed should trigger respective actions within ETN community in various forms: R&D projects, feasibility studies, best practice guidelines, development of standards or technical review papers.

The report was written by ETN's Project Board, encompassing experts from the user community, research institutes and universities, Original Equipment Manufacturers (OEMs), and suppliers. For specific topics, the Project Board was supported by selected ETN Members.

ETN would like to thank all the authors for sharing their skills and knowledge while contributing to the different parts of the report.

To download the report, please visit the [following page](#) on ETN's website. ■



## 4<sup>th</sup> European Micro Gas Turbine Forum event



The 4<sup>th</sup> [European Micro Gas Turbine Forum \(EMGTF\)](#) event was held right after ETN's 11<sup>th</sup> International Gas Turbine Conference (IGTC) on 11-12 October at the same venue, the Tangla hotel in Brussels, Belgium. ETN Global was a media partner for this event.

The 4<sup>th</sup> [EMGTF](#) event included keynote speeches from industry experts, panel discussions, and presentations of the latest findings from four years of research within the European Commission funded project, "Next Generation of Micro Gas Turbines for High Efficiency, Low Emissions and Fuel Flexibility", [NextMGT](#). [NextMGT](#) is a European Union's Horizon 2020 research and innovation programme under Marie Skłodowska-Curie grant

agreement No 861079. The aim of the programme was to train 15 outstanding early-stage researchers in the field of micro gas turbine technology, economics, policy, and regulations. During the 4<sup>th</sup> EMGTF event, they presented their project results and plans in a Pan-European Perspective.

The speakers also dived deeper into the findings of the four Work Packages (WP):

- WP1: Cycle Innovations and Optimization
- WP2: Combustion and Emissions
- WP3: System Component Innovations
- WP4: Industry Links, IP Management, and Commercialization

This event was the fourth event in the series initiated by EMGT, which is dedicated to advancing commercial deployment of micro gas turbines to support the future of sustainable and decentralised energy system.

To learn more about NextMGT project, visit the [project website](#).  
To learn more about EMGTF, visit the [forum's website](#). ■

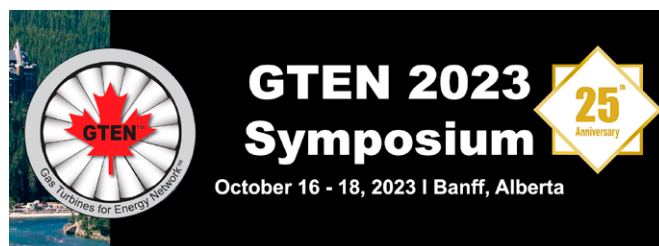
## ETN President's annual message to the members

Pedro Lopez, ETN's President, together with Christer Björkqvist, ETN's Managing Director sent an [annual letter](#) to the members in November 2023 (login required) expressing gratitude for members' engagement, providing a comprehensive overview of the organisation's achievements in 2023 and plans for 2024. The authors noted that in 2023, ETN experienced record-breaking success with numerous activities, projects, and webinars. Key highlights include the establishment of a Gas Turbine Life-Time Assessment and Extension Working Group and securing three new EC-funded projects.

An important shift also occurred with the introduction of the new name, Energy & Turbomachinery Network (ETN), symbolising a broader international focus. Anticipating global expansion in 2024, ETN plans strategic collaborations in key markets, to continue on-going projects and launch new initiatives with an emphasis on changing the perception of the gas turbine technology toward fully net-zero solutions.

The community can look forward to a year filled with virtual calls and face-to-face meetings, as well as two larger and all-encompassing events, which are the Annual General Meeting & Workshop on 19-21 March 2024 in Leiden, the Netherlands hosted by member NEM Energy, and the biennial Workshop on 08-10 October 2024 in Stuttgart, Germany. The comprehensive 2024 programme promises valuable activities, and new members are encouraged to engage with relevant Working Groups aligned with their expertise. Please find ETN's 2024 activity calendar [here](#) or visit our events page [here](#).

To read the full annual letter from ETN's President and ETN's Managing Director, please visit our news webpage [here](#) (login required). ■



## Gas Turbines for Energy Network 2023 symposium

Gas Turbines for Energy Network (GTEN) in Canada celebrated its 25<sup>th</sup> biennial Symposium, themed “*Gas Turbines and the Energy Evolution*” at the Fairmont Banff Springs Hotel in Banff on 16-18 October 2023. The event featured several training modules and presented 20 technical papers, focusing on decarbonisation for pipeline and power applications, CO<sub>2</sub> capture, hydrogen, operations, and maintenance, and air/GHG emission solutions.

ETN Global proudly participated as a supporting organisation, taking centre stage in the programme with two notable contributions:

- 16 October 2023: ETN's Managing Director Christer Björkqvist delivered a well-received keynote speech titled “*Global Collaboration for Dispatchable Carbon-Neutral Power & Heat Solutions*”.
- 17 October 2023: ETN's Client Relationship Manager Antonio Escamilla Perejon presented on “*Prerequisites for Use of Low-Carbon Alternative Fuels in GT Power Generation*”, resulting in an active and fruitful discussion.

To learn more about this event please visit the [event webpage](#). ■



Figure 5: ETN's Managing Director Christer Björkqvist during his keynote speech at GTEN's 25<sup>th</sup> Symposium





## 13<sup>th</sup> International Gas Turbine Congress

Gas Turbine Society of Japan (GTSJ) held its 13<sup>th</sup> International Gas Turbine Congress (IGTC2023) in Kyoto, Japan at the Kyoto Conference Centre on 26 November-01 December. The event featured keynote sessions with plenary discussions, technical papers covering the state of the art of gas turbine technology and an exhibition.

ETN Global proudly participated as a collaborating society, fostering international exchange. Managing Director Christer Björkqvist engaged in fruitful discussions with industry leaders strengthening ties and sharing visions.

A significant consensus emerged from the discussions: the gas turbine community, whether in Europe, US or in Japan, is united in its goal of accelerating development and demonstration of decarbonisation options.

While Japan leads in exploring ammonia as a future sustainable

fuel, Europe demonstrates a stronger inclination towards hydrogen. Despite these regional differences, there is a shared commitment to transitioning to carbon-neutral fuels and creating a portfolio of options.

ETN aims to facilitate the dissemination of results and the exchange of experiences from ongoing and planned demonstration projects to ensure a cost efficient and timely developments. Discussions also demonstrated a common stand that gas turbine technology will continue to be an integral part of the future energy landscape, ready to provide power and heat solutions alongside renewable energy sources.

To read more about the IGTC2023 Kyoto, visit the [event website](#).

## Global Power and Propulsion Forum 2024



The Global Power and Propulsion (GPPS) Forum, themed "*The Path to NET ZERO – Revolutionizing Energy Systems and Propulsion*" took place on 17-18 January in Zurich, Switzerland, hosted by ETH Zurich.

ETN's Managing Director Christer Björkqvist participated as a distinguished guest and panellist on 17 January 2024, contributing to two key sessions:

- Panel 1: *Regional Strategies for Decarbonizing Energy*
  - Panellists: Christer Björkqvist (ETN Global), Torsten Budenberg (Mitsubishi Heavy Industries EMEA Ltd), Fayette Collier (USG), Xuan Lv (SPIC, State Power Investment Company), John Gülen (Bechtel)
  - Chair: ZuoZhi Zhao (Siemens Energy)

- Panel 2: *Addressing Technological, Regulatory, and Economic Hurdles in the Hydrogen Value Chain*

- Panellists: Christer Björkqvist (ETN Global), John Gülen (Bechtel Corporation), Francis Bainier (GRTgaz), Oscar Mene Castiñeiras (Linde)
- Chair: Renaud Le Pierres (Meggitt)

The forum delivered valuable insights into achieving a safe, secure, and decarbonized energy supply, as well as sustainable air travel. The panel discussions were at moments very intense and rich in exploration of the optimal decarbonisation pathways considering technological advancements, regulatory frameworks, and economic considerations.

To read more about the GPPS Forum 2024 visit the [event webpage](#).



Figure 6: ETN's Managing Director during a panel discussion at GPPS Forum 2024

## ETN's webinar series: "R&D activities on sCO<sub>2</sub> in Europe"

ETN's sixth episode in the webinar series "R&D activities on sCO<sub>2</sub> in Europe" successfully took place on 14 February attracting more than 130 participants. This episode focussed on the Balance of plant and featured the following prominent speakers:

- [Matteo Baggiani](#), Business Unit Manager from [SIME](#), representing [CO2OLHEAT](#) project
- [Raymond C. Decorvet](#), Senior Account Executive from [MAN ES](#), representing [Esbjerg](#) project
- [Xijia Lu](#), Chief Innovation Officer from [NETPOWER](#)
- [Joshua Warren](#), Senior Research Engineer from [Southwest Research Institute](#), representing [STEP](#) project

ETN's webinar series were launched in September 2022 bringing together nine participating projects: [CARBOSOLA](#) (German national project), [COMPASsCO<sub>2</sub>](#), [CO2OLHEAT](#) (coordinated by ETN), [DESOLINATION](#), [iSOP](#), [SCARABEUS](#), [sCO<sub>2</sub>-Ejekt](#) (Czech national project), [sCO<sub>2</sub>-4-NPP](#), and [SOLARSCO2OL](#).

The webinar series were recently featured in a 4-page article in January/February issue of Modern Power Systems magazine under the theme "Carbon dioxide: working fluid of the future".

You can read the full article [here](#). We are grateful to the magazine for the coverage.

To read more about the sCO<sub>2</sub> webinar and to register, visit our [events page](#) to learn about the upcoming episodes in these series.

ETN Global invites you to its quarterly webinar series

**R&D Activities on sCO<sub>2</sub> in Europe (and beyond):**

**Balance of Plant**

6th webinar:  
Wednesday  
14 Feb 2024  
15-17h CET

Logos: CARBOSOLA, COMPASsCO<sub>2</sub>, CO2OLHEAT, DESOLINATION, iSOP, SCARABEUS, sCO<sub>2</sub>-Ejekt, sCO<sub>2</sub>-4-NPP, SOLARSCO2OL.

Carbon dioxide: working fluid of the future?

**sCO<sub>2</sub> on the horizon in the EU**

As reflected in a recent series of webinars organized by ETN Global, the sCO<sub>2</sub> power cycle is gaining momentum in Europe. The series of webinars, which took place on 14 February 2024, was the sixth in a series of six webinars organized by ETN Global. The series is part of the sCO<sub>2</sub> power cycle research and development project, which is coordinated by ETN Global. The project aims to develop a sCO<sub>2</sub> power cycle that is efficient, reliable, and scalable. The project is funded by the European Union and the German Federal Government. The project is a joint effort between ETN Global and several other companies, including CARBOSOLA, COMPASsCO<sub>2</sub>, CO2OLHEAT, DESOLINATION, iSOP, SCARABEUS, sCO<sub>2</sub>-Ejekt, sCO<sub>2</sub>-4-NPP, and SOLARSCO2OL.

The article features several diagrams and images related to sCO<sub>2</sub> power cycles, including a schematic of a sCO<sub>2</sub> power cycle, a photograph of a sCO<sub>2</sub> power cycle component, and a photograph of a sCO<sub>2</sub> power cycle component.

## ETN's LM-2500 User Group Meeting

**Save the date!**

**ETN's LM-2500 User Group Meeting**  
04-06 June 2024, Utrecht, the Netherlands

ETN's LM-2500 User Group Meeting will be held at Crowne Plaza Utrecht - Central Station hotel in Utrecht, the Netherlands on 04-06 June 2024. Representatives of LM-2500 user companies are invited to save the date.

The three-day event will include the following agenda:

- **User sessions:** discussions among users on top-priority topics
- **Technical sessions** with selected service providers & suppliers
- **GE aviation sessions:** special session on latest developments & upgrades and technical discussions on high-priority topics
- **Networking opportunities** during breaks and at dinner
- **Exhibition opportunities**

Registration will open end of February to LM-2500 user companies.

To learn more about ETN's LM-2500 user group meeting, please visit our [event webpage](#).



## ASME Turbo Expo 2024

ASME Turbo Expo (Turbomachinery Technical Conference & Exposition) 2024 titled “Unlocking a Net-Zero Future in Propulsion and Power” will be held on 24-28 June 2024 at ExCeL London, United Kingdom. It is a 5-day conference and a 3-day exhibition event. This year the focus is on achievements and needs to unlock a net-zero future in propulsion and power.

ETN Global will be present at the event as a media partner of the conference, and we will be in the exhibition area at our booth number 311.

ETN's Managing Director Christer Björkqvist will be involved in the planning of selected panel sessions that include gas turbine users and the Original Equipment Manufacturers (OEMs). And our Young Engineers Committee will host a Career Insight Event designed for students to learn about possible industry career paths on 23 June.

ETN Members are entitled to a discount when attending the full 5-day conference. To receive the discount code, please contact the [ETN Office](#).

To register and learn more about ASME Turbo Expo 2024, visit the [event website](#).



## ETN's October Workshop 2024

ETN's October Workshop 2024 will be held on 08-10 October in Stuttgart, Germany.

We would like to invite all our members to join us for this 2,5-day event which will consist of training courses on 08 October, followed by interesting presentations and discussions as well as networking opportunities on 09-10 October.

All our members are invited to save the date and check [our event page](#) for updates.

## Interview with Donnie Macmillan from Comhairle Nan Eilean Siar (CNES): ROBINSON project partner



**Donnie Macmillan,**  
Waste and Recycling  
Services Manager, CNES

### *What is the role of Comhairle Nan Eilean Siar (CNES) in the ROBINSON project?*

CNES is the municipality in Scotland for the Outer Hebrides islands (also known as Western Isles). As a follower island representative, CNES will provide experience and insight into the management of an energy system for an island group with a huge renewable resource potential (in terms of wind/wave energy), which is currently underexploited due to limited connectivity to the main national grid. They will guide and steer the project to produce practical and economic solutions built around realistic business cases. Through CNES the research partners will be able to access historical data from the Western Isles electrical grid showing supply and demand data and detailed data concerning the energy assets owned and operated by the council including an innovative integrated energy system with biogas, hydrogen (generation through electrolysis, storage and use as a vehicle fuel), wind energy and industrial symbiosis with salmon farming. CNES will work with the

partners to develop the replication study for the Western Isles which will outline the potential of the Energy Management System (EMS) and a selection of the elements demonstrated on the island of Eigerøy in Norway (ROBINSON project's demonstration island) for decarbonising its own island energy system.

### *What are the main challenges and opportunities for Western Isles in demonstrating the replicability of the modular EMS and the developed concepts?*

One of the main challenges and opportunities of this process for our region is ensuring that the development of the modular EMS has built in inherent flexibility to utilise broadly similar technological solutions for variable scenarios. By this I mean that while many islands, or island groups, may have many commonalities regarding opportunities and challenges e.g., both the Western Isles and Crete as follower islands would like to reduce the reliance on fossil fuels for electricity generation. However, to address the same challenge, the Western Isles may embrace the plentiful wind as a resource, while Crete may consider the ample solar opportunities to reduce fossil fuel consumption on the islands. Two totally different potential solutions to the same challenge. Thus, the need for built in inherent flexibility within the EMS. Progress to date on the EMS design within the ROBINSON project suggests to me this is entirely achievable.

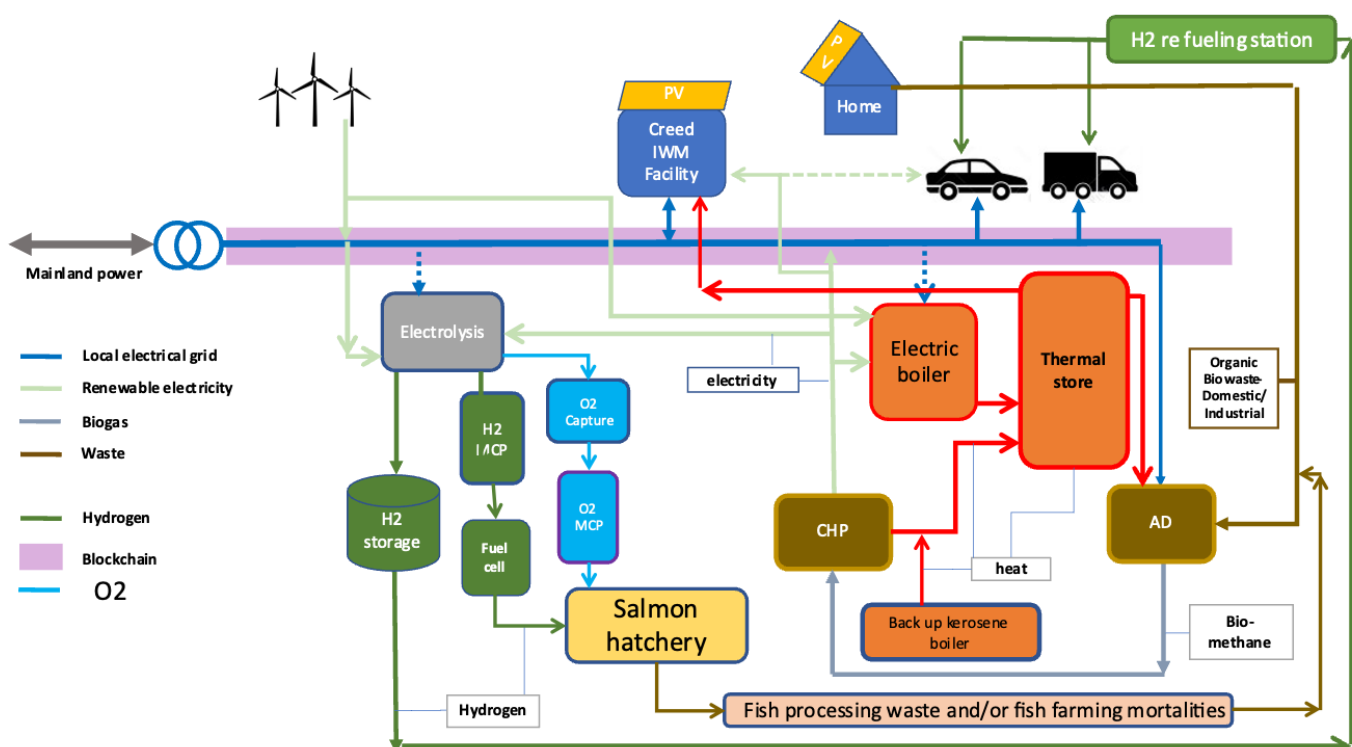


Figure 7: Western Isles current installation

continued on page 14



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### Could you tell us more about the Creed Park Integrated Waste Management Facility and its future role in the ROBINSON project?

Since opening in 2006 the Creed Park Integrated Waste Management Facility in the Western Isles has developed from primarily being no more than an Anaerobic Digestion plant with a biogas combined heat and power (CHP). The primary function was for the diversion from landfill by the treatment of the organic fraction of domestic municipal solid waste.

Since 2006 the site has evolved and today includes the following installations (see image “Western Isles current installation”):

- A hydrogen electrolyser with bulk storage and a hydrogen re fuelling station
- A wind turbine
- A fish pasteurisation plant
- A thermal store and electric boiler
- An oxygen recovery plant and O<sub>2</sub> cylinder charging facility
- A hydrogen fuel cell
- A dual fuel hydrogen/diesel refuse collection vehicle

All this additional development allowed us to develop a symbiotic partnership with a salmon farming and processing company permitting us both to contribute to considerable carbon



savings and a reduction in our reliance on grid electricity, and use of fossil fuels, and working on a creation of a circular economy roadmap.

Given that this site has evolved to what we have today over the past 17 years the hope is that the development of the ROBINSON EMS will permit the integration of the various energy and control management systems that are currently in place but generally working independently of each other.

The next evolution of the site has just started with the development of the €2.75 million Creed Hydrogen Skills and Innovation Centre Project. This will combine an educational and training facility with an operational commercial hydrogen production facility.

What is next? Our hopes and aims for future development are the installation of an appropriate energy storage facility to integrate with the wind turbine (see image for illustration “Outer Hebrides Local Energy Hub Delivering a Circular Economy”). ■

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

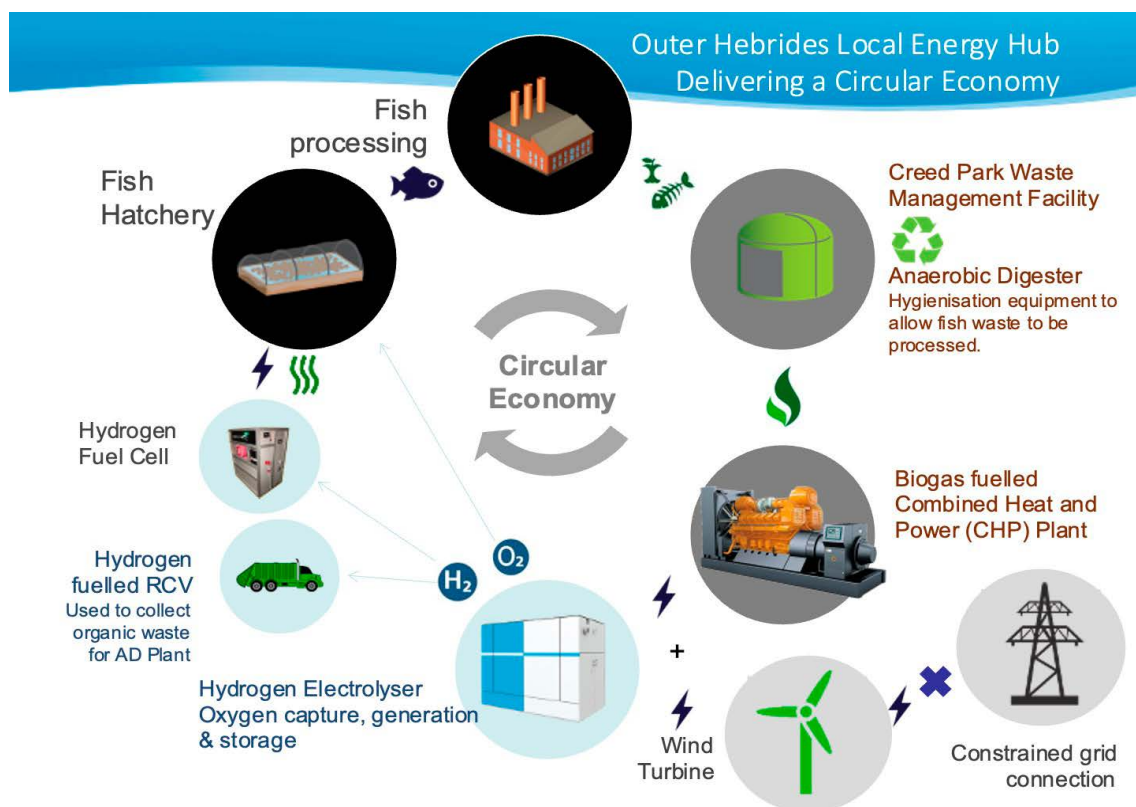


Figure 8: Outer Hebrides Local Energy Hub Delivering a Circular Economy

## Interview with Fritz Zaversky from Centro Nacional de Energías Renovables (CENER): ASTERIX-CAESar project coordinator



**Fritz Zaversky, Project Manager - Principal Research Engineer - Head of Thermal Simulation, CENER**

### What is the ASTERIX-CAESar project about?

The specific problem we are tackling is twofold: (1) The energy storage issue of the power grid, which limits the maximum capacity of non-dispatchable renewable technologies, and (2) the low conversion efficiency of concentrated solar power (CSP) plants.

To counter this problem, we propose the innovative combination of a Concentrated Solar Power (CSP) combined cycle plant integrating the compressed air energy storage (CAES) technology, to provide electricity storage and maximize solar-to-electric energy conversion.

### What is the role of the project coordinator?

The project coordinator has the responsibility for the scientific and technological management of all work packages (WPs), counting on the expertise of all consortium partners, in particular all task and work package leaders. As the project coordinator, CENER, will also be the leader of the Concept Definition and Techno-economic Optimisation WP, as well as of the Solar Receiver Development WP. At CENER we have the key knowhow on high-tem-

perature solar receiver development and system simulation and optimisation, which is necessary for the success of the project.

### What is the gamechanger in the project?

The game changing concept is to offer very cost-effective electricity storage with longest plant lifetime (> 25 years), being considerably more competitive than batteries and on a par with current state-of-the-art hydroelectric energy storage. Additionally, the concept provides a breakthrough in CSP power plant efficiency. It is possible to double the solar-to-electric energy conversion efficiency to reach competitive Levelised Cost of Electricity (LCOE) for CSP. The concept provides dispatchable electricity from solar energy, maximising the integration of all renewables in the power grid, relying upon heavy duty turbo machinery and fluid-thermic components, which all have highest recycling rates and lowest environmental impact. ■

Learn more about the project and receive updates on: <https://asterix-caesar.eu/>

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This project has received funding from the European Commission – Horizon Europe programme under grant agreement No 101122231

This project is supported by UKRI grant number 10097908 (Bluebox Energy). This project has also received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).

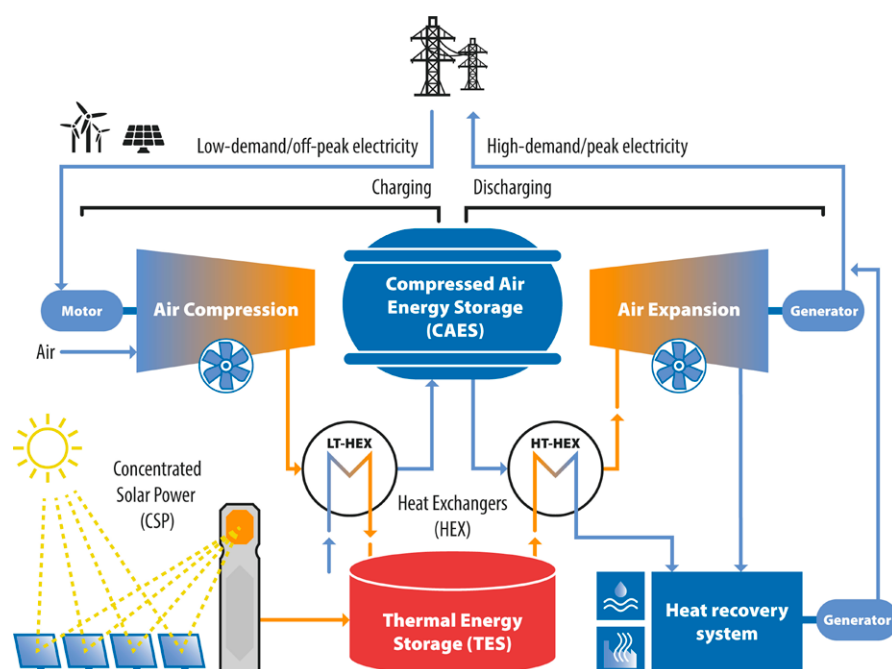
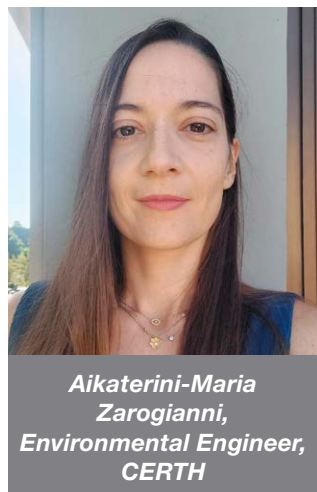


Figure 9: ASTERIX-CAESar project's overall concept



## Interview with Aikaterini-Maria Zarogianni from Centre for Research & Technology Hellas (CERTH): FLEXnCONFU project partner



### ***What is the role of CERTH in the FLEXnCONFU project?***

The Centre for Research and Technology Hellas (CERTH) is a prominent research centre in Greece known for its expertise in addressing cutting-edge technological research challenges. The centre is leading one out of nine work packages (WP) of FLEXnCONFU project, package number seven titled "Impact and benchmark-

ing", while also contributing to the control algorithm development through detailed simulations for WP3 – "Integrated plant: balance of plant innovations, control and dynamics".

CERTH's main role is to conduct the Life Cycle Assessment (LCA) and the Life Cycle Costing (LCC) of the Power-to-X-to-Power (P2X2P) paths to examine the environmental and economic effects of advanced FLEXnCONFU solutions. The assessment covers all stages of a product's life cycle, including manufacturing, operation, and end-of-life considerations, based on real-world data from combined cycle power plants. Specifically, CERTH develops modules of each component of both Power-to-Hydrogen-to-Power (P2H<sub>2</sub>P) and Power-to-Ammonia-to-Power (P2A2P) processes, investigates scale-up scenarios using LCA methodology and evaluates predetermined case studies of the FLEXnCONFU project. Beyond environmental and financial aspects, CERTH also investigates the social acceptance of the new energy pathways involving non-conventional fuels by conducting a social Life Cycle Assessment (sLCA). This comprehensive approach ensures a thorough evaluation of FLEXnCONFU solutions across environmental, economic, and social dimensions.

### ***CERTH is currently assessing the social impact of FLEXnCONFU technological solutions. Can you provide some information on the objectives and the expected results of such activities?***

As societies gradually become less carbon-intensive, hydrogen and ammonia systems are becoming more and more viable options in a variety of industries. The technical and the economic feasibility of the P2X2P systems will be explored in combination with the social impacts of FLEXnCONFU technological solutions. In the framework of FLEXnCONFU project that

considered a notable endeavour in this transition, the possible social risks through the life cycle will be evaluated adopting the social Life Cycle Assessment (sLCA) approach.

The sLCA approach applied in the FLEXnCONFU project encompasses several crucial objectives. First and foremost, it seeks to identify and analyse both the social challenges and benefits that accompany the implementation of the project. This includes assessing potential risks and advantages at various stages throughout the entire life cycle of the project. Another objective is the determination of the level of social acceptance regarding the scale-up scenarios. This aspect is particularly significant, as the success of any technological innovation heavily relies on the willingness and support of the communities and the stakeholders involved.

For the analysis of social impacts, a number of social issues, which are in line with the project objectives are being investigated. These issues include the health and safety, the environment, new technologies, public awareness, the contribution to economic development, legislation, and finance. In contrast to LCA, which attributes its impacts to physical flows throughout the entire life cycle, sLCA attributes its impacts to stakeholder relations. The project engages with three stakeholder categories: technology providers, distribution system operators (DSOs), and the local community. Each of these stakeholders holds unique perspectives and concerns that need to be considered in the evaluation. The involvement of stakeholders in development and operational stage is crucial and will reveal us their point of view regarding our scientific research and its outcomes. Several valuable conclusions will be drawn, and we will be able to assess positive and negative impacts of our study.

The outcomes of this assessment will provide the perspectives of the local communities regarding the new type of energy production. Moreover, the aspects and priorities of technology providers and the DSOs regarding the energy consumption, the protection of the environment and the adoption of innovative technologies will be illustrated.

### ***CERTH's focus on economic and environmental impacts showcases the complexity of the energy transition. What results do you expect such analysis will bring?***

Advanced and alternative energy systems are receiving plenty of attention since there is a pressing demand for energy transition globally. The Renewable Energy Systems (RES) are developed in experimental (R&D) and in simulation (model) way, technologically and financially. These systems are completed by conducting the life cycle assessment (LCA), which will also

*continued on page 18*

continued from page 17

be the case for FLEXnCONFU project.

Specifically, an integrated approach, encompassing the three pillars of sustainability, environmental, economic, and social aspects, will effectively assess the renewable energy sources. The goal of the LCA is to evaluate the environmental consequences of these systems throughout the different stages (manufacturing, transportation, installation, operation, end-of-life) of their entire life cycle acquiring valuable knowledge for the total environmental footprint.

A meticulous planning is therefore necessary for the LCA of RES including the definition of the goal and scope, selection of functional unit, the system boundaries as well as the appropriate data inventory regarding the input and output material and energy flows and the emissions to atmosphere, water, and soil.



In the FLEXnCONFU project, Key Performance Indicators (KPIs) are being used to evaluate the progress towards project objectives. The data which will be assessed will encompass the following:

- Global Warming Potential per unit of energy (GWP<sub>e</sub>) or per unit of mass (GWP<sub>m</sub>), which represents the total mass of greenhouse gas (GHG) (kg CO<sub>2</sub>eq) emitted by the FLEXnCONFU system per total energy produced by the system (kg CO<sub>2</sub>-eq/MWht) or per amount of fuel produced through the system's life cycle (e.g. kg CO<sub>2</sub>eq/kgH<sub>2</sub>).

- Cumulative Energy Requirement (CER), which represents the total amount of primary energy resources necessary to deliver the FLEXnCONFU demo sites (MJprimary).
- Levelized Cost of Energy (LCOE) which is the present cost associated with the gas production of a P2X2P system throughout its life cycle, accounting for various parameters such as the capacity factor of the plant (€/MWht).
- Capital expenditure (CAPEX) in €, as well as operational expenditure (OPEX)

Comparing the calculated KPIs of the FLEXnCONFU system with the conventional system will reveal the possible economic viability, the societal acceptance, and the environmental benefits of the innovative systems, such as the one used in FLEXnCONFU project. ■

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

## THE LIFE OF THE GT COMMUNITY

### Upcoming meetings and events

Preliminary list of meetings/events*	Date	Location
ETN 20 <sup>th</sup> Annual General Meeting & Workshop	19-21 March 2024	Leiden, the Netherlands
ETN Board Meeting	20 March 2024	Leiden, the Netherlands
ETN Project Board Meeting	20 March 2024	Leiden, the Netherlands
ETN YEC Meeting	20 March 2024	Leiden, the Netherlands
ETN's LM-2500 User Group Meeting	04-06 June 2024	Utrecht, the Netherlands
ASME Turbo Expo with ETN stand**	24-28 June 2024	London, United Kingdom
ETN user meeting in conjunction with Turbomachinery & pump symposia	20-22 August 2024 (exact date TBC)	Houston, Texas, United States
ETN October Workshop	08-10 October 2024	Stuttgart, Germany

\* For the full list of ETN-led & other international 2024 meetings & events, visit our [calendar on the website](#).

\*\* ETN members are entitled to a discounted registration fee.



## EC establishes stakeholders request mechanism for EU Taxonomy on sustainable activities

On 17 October 2023, European Commission (EC) established a [stakeholder request mechanism](#) in collaboration with the [Platform on Sustainable Finance](#); a mechanism, which is designed to gather input from stakeholders on activities essential for the net-zero transition within the [EU taxonomy](#) (EU taxonomy refers to a classification system developed to identify activities that are environmentally sustainable and adhere to the following goals: climate change mitigation and adaptation, sustainable use of water and marine resources, pollution prevention, and protection of biodiversity).

Stakeholder request mechanism allows the opportunity to propose new economic activities for inclusion in the EU taxonomy (if they are evidence-based) or suggest revisions to the screening criteria of existing activities.

The [Platform's Technical Working Group](#) were tasked to process submitted requests received by 15 December 2023, with a subsequent cut-off date to be announced later.

ETN submitted our contribution to EU taxonomy via a [stakeholder request mechanism](#) on 15 December 2023 urging the EC to include Waste Heat to Power (WH<sub>2</sub>P) activities under EU Taxonomy, aligning the benefits that WH<sub>2</sub>P provides with EC's overarching goal of fostering sustainable practices and contributing to environmental objectives. We have emphasised the following benefits:

- Reduced primary resource consumption for electricity production:
  - By harnessing waste heat, WH<sub>2</sub>P lessens the dependence on primary resources for electricity generation, contributing to a more sustainable energy mix.
- Decreased primary resource usage for cooling down waste heat flow:
  - The process also leads to a reduction in the need for primary resources to cool down the waste heat flow, promoting resource efficiency and conservation.

- Increased efficiency of the electricity chain:

- WH<sub>2</sub>P enhances the overall efficiency of the electricity chain, making energy production more streamlined and environmentally friendly.

ETN has also emphasised that WH<sub>2</sub>P has the potential to make substantial contributions to three critical environmental objectives outlined by the EC:

1. Climate Change Mitigation: By optimizing energy use and reducing reliance on traditional sources, WH<sub>2</sub>P actively supports efforts to mitigate the impacts of climate change.
2. Climate Change Adaptation: the process aligns with the adaptation strategies necessary to navigate the challenges posed by a changing climate, providing a sustainable energy solution.
3. Transition to Circular Economy: WH<sub>2</sub>P embodies the principles of a circular economy by repurposing waste heat into a valuable resource, contributing to a more sustainable and circular industrial ecosystem.

We are confident that through the EU taxonomy stakeholder request mechanism, our compelling arguments will pave the way for the inclusion of WH<sub>2</sub>P, ensuring it aligns with the taxonomy's criteria and paves the way for a more sustainable and circular economy.

ETN's request will be processed together with all the other inputs by the [Platform's Technical Working Group](#) in early 2024. The Working Group will then provide a summary of the requests received, together with a process describing how they were assessed and what recommendations the Platform made based on the requests.

You can access the EU taxonomy stakeholder mechanism tool [here](#) and read the full press release from the EC regarding the tool [here](#). ■



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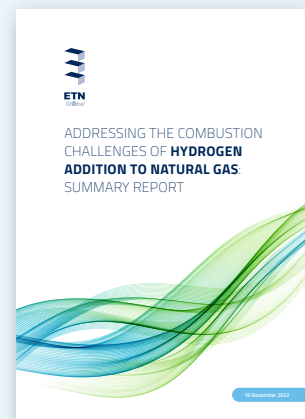
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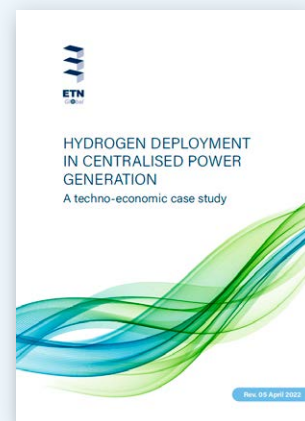
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