ETN NEWS

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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.

In this issue

Christer Björkqvist
Managing Director

Engage, Coordinate and Impact

ETN's newly adopted vision "Safe, secure, affordable and dispatchable carbon-neutral energy solutions by 2030, implemented globally by 2050" is based on a changing global energy landscape and wide national alignment on a 2050 carbon-neutrality target.

Governments will now need to develop a realistic path to achieve these targets with concrete steps and incentives that can kick-start this transition. Latest figures from the International Energy Agency show a global 2% increase of carbon emissions between December 2019 and December 2020, indicating the urgency to act. Last week President Biden hosted the Leaders Summit on Climate with 40 world leaders to underscore the urgency and economic benefits of stronger climate actions.

The European Commission's executive vice-president. Mr. Timmermans, in charge of the Green Deal, recently stated that "the future is in carbon-free electricity and a decarbonised gas sector, which embraces hydrogen as an energy carrier and green hydrogen as the final destination".

The US has equally announced its preliminary plans to reach net zero emissions by 2050, backed-up by a hydrogen strategy developed by the US Department of Energy.

To accelerate a sustainable transition in Europe, the EU Commission published the climate change section of its "sustainable finance taxonomy", and the first part of its implementing rules. It is a complex system that classifies which investments will be regarded as sustainable from an environmental perspective, based on science criteria. The two big questions that have provoked a strong disagreement among many member states are if nuclear power will be labelled "green" and if natural gas power generation will be accepted as sustainable in the transition phase. In the end the European Commission decided to leave them out, recognising that the role and contributions of these technologies would require further considerations and will be dealt with separately in a second batch. The good news is that the EU Commission is optimistic on hydrogen, noting its "multiple low-carbon applications and uses of hydrogen as an energy carrier, storage solution, fuel or feedstock."

As it stands now, the EU taxonomy is missing the valuable short-term emission reduction, stability and security of supply contributions that highly efficient dispatchable gas turbines running on natural gas and hydrogen blends can provide. To convince the European Commission, the EU member states and the European Parliament, it will be important to highlight these points, as well as the clear path towards carbon-neutral solutions, enabling large-scale integration of renewables, clean power generation, vital distribution and seasonal energy storage solutions.

The wide role and the numerous development opportunities of gas turbines will be highlighted in ETN's new Vision document and R&D Recommendation Report, both to be released in May.

With our new strategy in place, "engage, coordinate and impact", ETN Global will be working hard to ensure a successful implementation and execution to progress towards our common vision. Make sure that you are on board!

ETN's Virtual Annual General Meeting & Workshop

ETN's successful Virtual Annual General Meeting & Workshop Week took place on 15-22 March 2021. We would like to thank our members for their active participation throughout the event week: we had very interesting sessions, excellent presentations and good discussions, resulting in many new ideas to work on – read more below!

At the Annual General Meeting (AGM), ETN's General Assembly concurred with the ETN Board's proposed vision, strategy and budget going forward. The AGM was followed by ETN's Workshop, which consisted of four Technical Committee (TC) sessions, addressing topics of high interest to the gas turbine user community:

- **TC1**: Low-carbon GT technologies – "Expanding the solutions portfolio of new energy systems"
- **TC2**: Operational and fuel flexibility – "Analysing new technological solutions in respect of market opportunities"
- **TC3**: Materials degradation, repair technologies & manufacturing – "Expected materials impacts and new technology opportunities to overcome challenges in the energy transition"
- **TC4**: Condition monitoring and asset management – "Implications of introducing 5% to 30% hydrogen into the grid"

We organised also a virtual closing session "ETN strategy implementation and transition roadmap", summarising the outcome of the Technical Committee sessions and follow-up actions. The closing session gave a good overview of ETN's involvement in EU's research and innovation activities, and provided an opportunity to find out the latest updates within ETN's Working Groups and hear more about the planned activities from the Working Group chairpersons and co-chairs. The session included updates also on ETN's User Groups and the Young Engineers Committee. Presentations from all AGM & Workshop sessions are available on our website.

The Board, Project Board and ETN office have already started working on the implementation of the many initiatives/topics that were brought forward by our members. These include topics such as pressure gain combustion; carbon capture utilisation and storage (CCUS); hydrogen and ammonia economics benchmarking; new GT cycles and process integration; materials challenges for the implementation of exhaust gas of sCO_2 cycles; additive manufacturing component quality control/assessment; enclosure standard for hydrogen; hydrogen readiness assessment process; and several cooperation opportunities with external organisations. Many of these topics will be discussed and implemented at ETN's relevant Working Group meetings.

New Decentralised Energy Systems Working Group

During the AGM & Workshop closing session, Peter Breuhaus, Chair of ETN's Project Board introduced the Project Board's proposal to widen the scope of ETN's Micro Gas Turbine Working Group and rename it as Decentralised Energy Systems Working Group.

The goal of this new Working Group is to bring together stakeholders of the value chain for decentralised gas turbine (micro and small) energy solutions, with the objective to accelerate the development of cost-efficient integrated technology solutions in line with the market needs. The Decentralised Energy Systems Working Group aims to explore market opportunities and solutions, initiate cooperation projects to reduce cost and increase the technology readiness level of individual components, the gas turbine system and its integration into decentralised and multi vector energy systems.

The ETN Project Board will now further discuss the objectives and coverage and plan the official launch of the new Working Group later this year.

ETN Activity Update 2020-2021

Ahead of the AGM, the ETN office prepared the annual Activity Update, which is the annual report of ETN activities taken place since the AGM 2020. This document provides a good overview of current ETN topics and gives more detailed information and updates on all activities. The Activity Update can be downloaded here (login required). ■

ETN User Groups

ETN's LM2500 and SGT-A35 User Groups are preparing their annual meetings. The latest developments and solutions related to the topics raised by the user community will be presented by technical experts from the OEMs and selected service providers, invited by the user community. The objective is to share experiences and implement solutions to improve the users' gas turbine operations: ETN's User Groups allow deep dive technical exchange with the OEMs and service providers.

Our LM2500 and SGT-A35 User Groups have applied the same concept for several years, which has proven to be an excellent way to provide a continuous and focused dialogue between the user community, OEMs and service providers.

Both groups go through an anonymous collection of topics and issues experienced by the operators, coordinated by ETN. The topics are then discussed during the engine-specific preparation meetings, ranking the most important topics to be addressed for both user communities. The agenda of each meeting is created by the users, which makes this a unique approach: both User Groups act with an independent voice, requesting solutions and improvements from different players active on the market. This approach aligns the user community's requests and provides valuable information and data to the OEMs and service providers, facilitating a focused development of solutions in line with the users' needs.

ETN's annual LM2500 User Group Meeting will be held virtually on 15-17 June 2021. More information will be shortly updated to ETN's website.

The SGT-A35 user community will hold a meeting on 28 April to discuss the updates from last year's event and to plan the activities for 2021. Another teleconference meeting will take place on 19 May with the representatives of Siemens, who will address updates on the topics presented and discussed at ETN's SGT-A35 User Group meeting 2020. For further information on ETN's User Groups, please contact us. ■

Flexible Power Generation webinars: closing episode

The closing episode of ETN's popular Flexible Power Generation webinar series ***"R&D for flexible power generation: today's and tomorrow's challenges and pathways"*** took place on 20 April 2021. The five EU-funded projects (FLEXnCONFU, HYFLEXPOWER, PUMP-HEAT, sCO_2-flex and TURBO-REFLEX), which were introduced during the first five episodes of ETN's webinar series, have focused their efforts in developing a broad array of solutions to increase flexibility while lowering GHG emissions: power-to-x-to-power solutions, low-carbon gasses combustion, heat pumps, supercritical CO_2, components and machine optimisations. All these solutions will respond to the different needs across Europe, supporting and strengthening the energy systems in the short, medium and long-term.

The final episode brought together the five project coordinators with the representatives of ETIP SNET and the European Commission, to discuss next steps and future research direction for flexible power generation, as well as opportunities ahead. All presentations are available on ETN's website. ■

IGTC International Gas Turbine Conference

International Gas Turbine Conference 2021: *save the date!*

Due to health risks associated with the COVID-19 pandemic, travel restrictions, and the uncertainty of whether face-to-face events will be possible later this year, the ETN Board, supported by the General Assembly, has taken the decision to hold ETN's 10th International Gas Turbine Conference (IGTC) entirely virtually. The conference, scheduled for 11-15 October 2021, will include 5 keynote sessions, 10 technical sessions (with 30 technical papers to be presented), a virtual exhibition lounge and innovative networking opportunities. More details will be shortly updated to our website – stay tuned! ■

ASME Turbo Expo

ASME Turbo Expo virtual conference will be held on 7-11 June 2021. The conference theme will be "Sustainable Energy – Accelerating the Transition by Advancing Turbine Technology".

ETN's Managing Director Christer Björkqvist will moderate the plenary session *Opening up the Design Space to Afford Efficient Gas Turbines Using H_2 and Biofuels*, to be held on 8 June 2021. Christer Björkqvist will be also co-chairing the panel sessions *Voice of Customers* (8 June) and OEM session *Pathway Forward for Gas Turbines* (10 June).

ETN members are entitled to a discounted registration fee for the conference. For more details, please contact the ETN office. ■

ASME® 2021 TURBO EXPO
Turbomachinery Technical Conference & Exposition

CONFERENCE
June 7–11, 2021
Online, Virtual

ETN Global

Calendar of upcoming meetings and events

As we continue with virtual meetings, the ETN team is regularly updating our calendar of upcoming meetings and events. Check out the planned ETN meetings and events for 2021 via this link. ■

ETN Global

Educational courses

ETN is collecting information about technical gas turbine courses available, given by ETN members, to promote and share 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. ■

ROBINSON: tailor-made decarbonisation of energy systems on geographical islands

A step-by-step approach to decarbonisation – profiling the islands

*In October 2020, ETN added to its portfolio one more EU funded project: ROBINSON – **"smart integRation Of local energy sources and innovative storage for flexiBle, secure and cost-efficIent eNergy Supply ON industrialized islands"**. With the goal to help decarbonise (industrialised) islands, ROBINSON partners aim to support islands through the development of an intelligent, flexible and modular Energy Management System (EMS), better integration of Renewable Energy Sources (RES), biomass and wastewater valorisation, industrial symbiosis, and the optimisation and validation of innovative technologies.*

Challenges and opportunities

Helping islands achieve decarbonisation is certainly not an easy task due to their natural isolation, which brings along a broad array of (energy) challenges, and the uniqueness of each island, which implies that there is no silver bullet solution for their decarbonisation.

Each island needs tailored-made solutions that could provide clean, cost-efficient and reliable solutions adapted to fit unique needs (e.g. geographical situation, population and local economy). However, a common requirement is an efficient dispatchable technology that can provide in a secure and sustainable way the required back-up electricity to weather-dependent energy sources and heat solutions according to market needs. Gas turbine is a unique, versatile technology that can be developed to fulfil all these needs by using carbon-free molecule-based fuels such as hydrogen, synthetic methane or other renewable fuels.

Geographical islands can offer the ideal conditions to implement and integrate several technologies and key practices for an efficient decarbonisation of such energy systems. This approach involves integration and optimisation of the use of Renewable Energy Sources (RES) with a dispatchable technology and efficient use of local resources (and local waste) that require an innovative energy management system integrating the different energy vectors. To unlock this potential, the first step is to analyse the energy profile and the needs of the islands. This is why during the first six months of the project the ROBINSON partners focused on mapping the current situation at the demo island (Eigerøy, Norway) and the project's two follower islands (Crete in Greece and the Western Isles in the UK).

Profiling the demo island: Eigerøy (Norway)

An encompassing and analytical (energy) profile of the island, highlighting also main challenges faced locally, is key to select the right technologies to shape the integrated energy system that is best suited to cover current and future energy needs, in terms of both power and heat.

Taking into account the main goal of Eigerøy, which is to build on this experience and cover additional energy needs (electrical and thermal) by innovative integration of the locally available RES, thus also avoiding expensive capacity extensions of the already existing connections to the mainland to cover the new and future needs, the analysis needs to cover several interconnected aspects:

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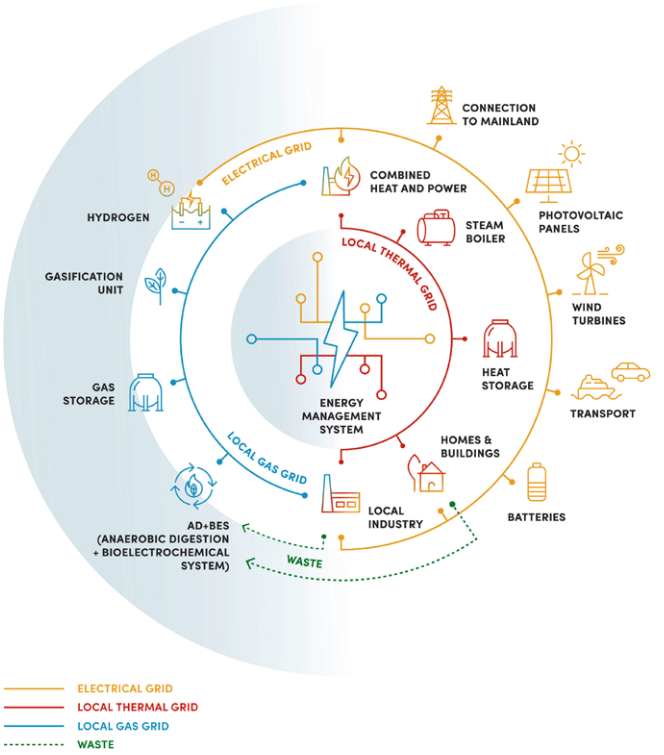
- Mapping of already installed infrastructure on the local energy system's production, distribution, and demand side;
- Mapping of the topographic conditions of the demonstration island in terms of dimensions, accessible area, and potential constraints resulting from local regulations;
- Analysis of the demand-side energy consumption including the currently available information and the energy consumption profile;
- Overview of the identified stakeholders, as well as their needs and interests.

At Eigerøy, almost 100% of the electricity is provided through cables from the mainland, and this power is generated mainly from hydropower (89,2%), with 8,6% onshore wind power with and 2,2% thermal power. 88% of the electricity consumption is from industry. However, in the industrial sector on Eigerøy there are a considerable amount of fossil-fuel based thermal energy used especially in the fish industry (26 500 MWh/year), and there are also plans for more factories elevating both the need for more thermal energy and more electricity. The current energy system is not able to handle the upcoming demand.

ROBINSON's approach is to find the best way of solving the demand side when it comes to sustainability and convert existing fossil-fuel based energy with renewables without providing a costly new grid connection to the mainland, which also include considerable environmental impact.

Indeed, the current situation on the island allows for optimisation and reutilisation of resources that would be, otherwise, wasted. For example, the processes of the fish industry present locally require a large amount of high-temperature steam, which is currently supplied by an LNG fired boiler. The process also generates low-temperature waste heat, which other local industries could use for heating. This is exactly one of the aspects that ROBINSON is planning to investigate. Such integration has the potential to convert their current fossil-based heating systems to fossil-free, and thus achieve 100 % decarbonisation. To capture this potential, ROBINSON aims to develop, integrate and demonstrate a 400 kWel flexible gas turbine-based Combined Heat and Power unit (CHP) for extended fuel flexibility to run on syngas, bio-methane and green hydrogen also used as innovative energy storage (general targets: 40% of electrical efficiency, 90% of availability, up to 90% of overall efficiency in CHP mode running with syngas, bio-methane and hydrogen mix up to 30%; production targets: ~5000 MWh/year of heat and ~9000 MWh/year of electricity generated).



Secondly, an analysis of the topographic conditions is also needed to make sure the project can move concretely to ROBINSON's next phase, which encompasses to integrate and combine Eigerøy's existing infrastructure and pre-installed technologies with new technologies to allow energy balancing and storage for different time scales.

The importance of the topographical analysis lies in the fact that it considers not only the ideal location for the installation of the technologies, but also possible restrictions regarding the positioning of local power production, power-to-gas technology and energy storage units.

Conclusions

Installing an Energy Management System and energy production and storage technologies in an island offer a unique opportunity to test, improve and further develop renewable fuel-based Combined Heat and Power unit, but also the integration amongst the weather-dependent renewable energy sources in a decentralised energy system. The natural constraints of the location will "naturally" push for the optimisation of the decentralised energy system, in order to increase islands' independency from the mainland.

A full profile analysis of the location, as the one carried out by the ROBINSON's partners over the last six months, is a necessary and preliminary condition to work towards a tailor-made modular and adaptable solutions able to address all the different challenges islands face daily. ■

www.robinson-h2020.eu

Follow ROBINSON on &

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N. 957752.

Interview with Wim Dams, Project manager at Cummins Inc.

One of the final objectives of the FLEXnCONFU project is the development, integration and demonstration of power-to-hydrogen solutions to increase the flexibility of a combined cycle power plant. To achieve these results, the development and integration of a 1MW PEM electrolyser plays a pivotal role. To learn more about this technology, and its development and integration, we met with Wim Dams, Project manager at Cummins Inc.

Could you tell us what is Cummins' role in the FLEXnCONFU project?

Within the FLEXnCONFU project, Cummins offers its expertise as a leader in hydrogen production. Cummins will build a 1 MW electrolyser to be integrated in an existing Combined Cycle (CC) power plant. The Proton Exchange Membrane (PEM) electrolyser will deliver more than 200Nm³/h of hydrogen (H_2), matching the CC requirements. The electrolyser will be utilised as a smart load providing flexibility to the power plant.

What are the main challenges when designing and developing a PEM electrolyser?

The electrolyser utilises pioneering PEM technology; implementing this technology on an industrial scale can bring challenges. Safety, purity, flow and reliability are the most important factors when building a high-flow automated machine. To address these challenges, the FLEXnCONFU project will benefit from Cummins' expertise in designing and delivering systems that are automated and produce a high purity of hydrogen (99,999%), and comply to strict safety design standards globally. Cummins Inc. has already installed over 600 electrolysers across the world.

What are the challenges in integrating the electrolyser into an existing system?

Close cooperation with the consortium partners is key. Since the unit will be integrated in an existing system, the footprint, interconnections, local legislation, mass balance etc. have to be thoroughly aligned with the consortium partners.

You will provide to the project a 1MW Proton Exchange Membrane (PEM) electrolyser. What are the advantages of deploying a PEM electrolyser?

PEM is the most robust and efficient technology for pure hydrogen generation at scale. PEM electrolysers operate at high current densities with limited footprint, very dynamic operating ranges and with the ability to act upon load fluctuations with ultra-short response times. Together with

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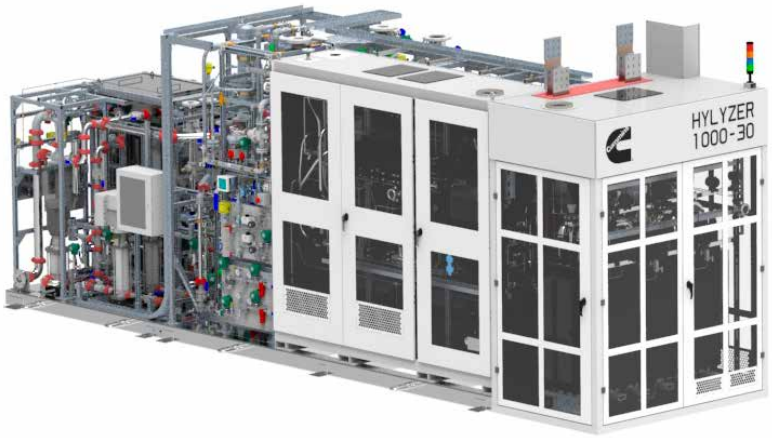
Cummins HyLYZER PEM Electrolyzer © Cummins



HyLYZER 1000 CAD © Cummins

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the long lifetime and the limited maintenance requirements, this results in highly reduced operational costs.

How can the power-to-hydrogen-to-power solutions contribute to the energy transition?

There has never been a keener appetite for energy transition than right now. With growing public demand for climate action, policy and business leaders are increasingly pushed to find a green gas solution. In the global race to display green credentials, we are seeing an increasing number of governments put financial and policy muscle behind lower carbon initiatives, and businesses are aligning on new purpose-led frameworks which put environmental sustainability to the fore. The cost of producing hydrogen from renewables is primed to fall, but demand needs to be created to drive down costs, and a wide range of delivery infrastructure needs to be built. EU funded projects such as FLEXnCONFU definitely support building these infrastructures.

Any last remarks?

Now that the unit is fully designed and built, the next steps are to use the electrolyser to test and validate new design ideas for future systems, improving fuel cell efficiency. With the increasing global interest in hydrogen as an energy carrier we see a trend towards much larger capacity systems, and fuel consumption is likely to be reduced by 20% to 35% as the technology is further refined. It is also expected that the fuel costs per kilogram of hydrogen will fall as distribution and retail infrastructure scale up. ■

www.flexnconfu.eu

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Subscribe to our FLEXnCONFU newsletter **here**

This project has received funds from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N. 884157.

European Commission's open consultations

In the framework of the European Green Deal, the European Commission opened recently several relevant public consultations, all of which will accept feedback from the stakeholders until June 2021.

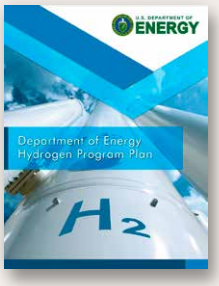
Hydrogen and EU gas market

The European Commission launched a new public consultation on hydrogen and decarbonisation of the EU gas market (revision of the Gas Directive and the Gas Regulation). Open until 18 June 2021, the consultation seeks to collect the views of key stakeholders ahead of the European Commission's legislative proposal for a new hydrogen and gas markets decarbonisation package (expected by the end of the year). The consultation is available here.

Projects of Common Interest: smart grids and cross-border CO_2 transport networks

For the upcoming weeks, stakeholders and public authorities will have the opportunity to comment on the candidate projects for the fifth list of EU Projects of Common Interest (PCI) in the fields of smart-grids (deadline 16 June 2021) and cross-border carbon dioxide transport networks (deadline 18 June 2021). To be considered a PCI, a project must play an essential role in granting affordable, secure and sustainable energy for all citizens and in completing the European internal energy market. As per TEN-E regulation, the list of PCIs is updated every two years. ■

US hydrogen strategy



At the end of 2020, the U.S. Department of Energy (DOE) released its Hydrogen Program Plan that provides a strategic framework for the department's hydrogen research, development, and demonstration activities. The Hydrogen Program Plan reinforces DOE's commitment to develop the technologies that can enable hydrogen expansion in the United States, and highlights the importance of collaboration both within DOE and with stakeholders in industry, academia, and the states to achieve that goal. The Hydrogen Program Plan can be downloaded here. ■

EU sustainable finance and taxonomy

Much is being said (and written) on sustainable finance and taxonomy: the eyes of the international finance communities are pointed at Brussels waiting for the next move of the European Commission (EC). But what are sustainable finance and taxonomy? And, where do we stand?

As per definition of the EC, in the EU policy context sustainable finance is understood as "finance to support economic growth while reducing pressures on the environment and taking into account social and governance aspects". Developed at European level, the goal of sustainable finance is to make sure that sustainability considerations are taken into account in the financial decision-making. In this way, private investments will complement public funds in creating an enabling framework to support the climate goals defined in the European Green Deal.

However, to be able to divert investments towards sustainable activities, a definition of "sustainable economic activity" is required. Those activities are identified in the EU taxonomy, which is a "unified EU Green classification system".

The Taxonomy Regulation entered into force in 2020 and will start applying as of 1 January 2023. It establishes six environmental objectives:

1. Climate change mitigation
2. Climate change adaptation
3. The sustainable use and protection of water and marine resources
4. The transition to a circular economy
5. Pollution prevention and control
6. The protection and restoration of biodiversity and ecosystems

To develop the EU taxonomy further, the EC is tasked with defining technical screening criteria for each environmental objective through delegated acts. So, through the delegated acts the EC is identifying the "substantially contributing", "enabling" and "transitional" economic activities of the next decades, including also power generation activities.

But, especially in power generation, discussions are heated. The first delegated act, presented in November 2020, generated hard reactions from several stakeholders, including 10 EU member states, for the limits imposed on electricity production using liquid and gaseous fuels (including but not limited to natural gas). To be recognised as transitional technologies, life-cycle GHG emissions of electricity produced with gaseous/liquid fuels should be lower than 100g CO_2e/kWh. This threshold implicitly denies CCGT power plants access to billions of investments.

The uproar generated by those unfeasible limits, which neglect the key role that efficient gas power generation can play not only in the decarbonisation of the energy system, but also in grid stabilisation, security of supply, and creation of alternative storage capabilities through power-to-x solutions, forced the EC to rework the delegated act.

The updated version of the delegated acts was released on 21 April. The 100g CO_2e/KWh lifecycle emissions threshold for energy activities has been maintained, and a threshold of 270g CO_2e/KWh recognising the activities "doing significant harm" has been added. In this new version of the taxonomy, the use of natural gas would not be recognised as sustainable. But, hearing also the pledges of several EU member states that recognise the key role that natural gas can play in the energy transition, the decision on natural gas, as well as on nuclear, has been postponed: *"In order to acknowledge the role of natural gas as an important technology in reducing greenhouse gas emissions, the Commission will consider a specific legislation to ensure that activities contributing to emissions reductions would not be deprived of appropriate financing."*

As for hydrogen production, the European Commission recognises that "*the activity complies with the life-cycle GHG emissions savings requirement of 73.4% for hydrogen [resulting in 3t CO_2eq/tH_2] and 70% for hydrogen-based synthetic fuels relative to a fossil fuel comparator of 94g CO_2e/MJ*".

The European Commission has not indicated a clear timeline for releasing the document focusing on gas. More clarity could eventually be expected in June, when the European Commission aims to release a new batch of implementing rules for transitional activities, together with several other legislative proposals linked to the Fit for 55 package. ■

Upcoming meetings and events

Meeting/Event	Date	Location
SGT-A35 User Group – follow-up of 2020 meeting**	28 April and 19 May 2021	Virtual meeting
ASME Turbo Expo*	7-11 June 2021	Virtual meeting
ETN LM2500 User Group Meeting**	15-17 June 2021	Virtual meeting
High-Level User Meeting**	4 October 2021	Virtual meeting
ETN's 10th International Gas Turbine Conference*	11-15 October 2021	Virtual meeting

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

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ETN at a Glance!

Download the ETN Brochure and find out more about our mission & objectives, activities, events and more!

Are you interested to become an ETN member? Download the one-pager showcasing the benefits of being part of ETN's global turbomachinery community.

Keep in contact and updated with ETN's most recent news.
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