ETN NEWS

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ETN is a non-profit association bringing together the entire value chain of the gas turbine technology community globally. Through cooperative efforts and by initiating common activities and projects, ETN optimises turbomachinery research and technology development and promotes the operation of environmentally sound gas turbine technology with high reliability and low cost.

In this issue

Christer Björkqvist
Managing Director

Gas turbine technology recognised as an enabler in a global low-carbon energy strategy

In the recent released communication and proposed strategy from the European Commission both hydrogen as an energy carrier and CCS have been highlighted as essential technology paths that require further development and implementation in order to meet the required emission reduction targets. Based on the fact that hydrogen can be used as a feedstock, a fuel, an energy carrier and as a medium and long-term storage solution, with possible applications across industry, power, transport and building sector, it is seen as the perfect companion to intermittent wind and solar power.

A number of support schemes are now in place to incentivise the required investments and developments. The Clean Hydrogen Partnership will support research and development with the objective to bring technology solutions up to demonstration readiness. The Clean Hydrogen Alliance will pool and scale industry resources and efforts to increase the impact and to achieve further cost reductions and an increased competitiveness. On top of this there is the EU ETS Innovation Fund, which will pool together around €10 billion to support low-carbon technologies over the 2020-2030 period. The fund can substantially reduce the risks of large and complex first-of-a-kind demonstrations projects, and therefore offers a unique opportunity to prepare such technologies for a wide-scale roll out.

This is great news for our industry in these COVID times and a confirmation of the belief in our technology to provide low-carbon and carbon-neutral solutions. It is now up to us to ensure the delivery of the required gas turbine development and timely demonstrations of the new solutions. The proposed EU energy strategy, of which you can read more about in this newsletter, sets out a vision on how to accelerate the transition towards a more integrated energy system. This will require coordinated cooperation across multiple energy carriers, infrastructure and consumption sectors.

At ETN's first virtual Annual General Meeting, Bernard Quoix highlighted, in his last speech as President of ETN, the importance of a wider and closer cooperation for our industry going forward. Both to overcome the current crises but also to secure the required developments for both the current gas turbine fleets and the next generation in an integrated and cost-efficient way, ETN has established Working Groups and Task Forces in all key areas of importance for our industry to stay relevant in the energy transition: hydrogen and ammonia, additive manufacturing, component life assessment and asset management, air filtration and supercritical CO_2. Make sure that you are involved and participate in the relevant group of your area of interest and expertise to help us accelerate the required developments.

Our newly elected President, Pedro Lopez, Uniper, and Vice President Hege Rognø, Equinor, have now taken over the leadership of ETN, strongly supported by the rest of the elected Board. All newly elected Board members are listed in this newsletter and presented more in detail on our website. Guided by the newly elected Board I look forward to exploring new opportunities and strengthening our position in the energy transition.

ETN's first virtual AGM & Workshop

ETN held a successful Annual General Meeting and Workshop entirely virtually, with very active participation by our members throughout the event week.

ETN's Virtual AGM & Workshop Week took place from 29 June to 3 July 2020. Our Annual General Meeting (AGM) was held on 30 June 2020, and the first part of the day was dedicated to the President's speech, ETN's annual report of activities, strategy discussion, financial report and ETN's Board election results.

The AGM continued with the panel session "Research and innovation challenges for gas turbines in a low-carbon world" with speakers from the European Commission, Total, Shell and Enel.

ETN's Workshop consisted of four individual two-hour sessions:

- Additive manufacturing and new materials
- Gas turbines operational and fuel flexibility
- Next generation power cycles
- Condition monitoring and asset management for energy transition

The AGM & Workshop Week was followed by ETN's Young Engineers Committee launch meeting – see more details on the following page.

We would like to thank again our speakers and all our participants for interesting discussions. Presentations are now available on ETN's website (login required). ■

ETN Activity Update 2019-2020

The ETN office has prepared our annual ETN Activity Update, which presents the key activities that have taken place since the last AGM in Pau, France, in March 2019. You can download the full report here (login required). ■

New ETN Board 2020-2022

In June 2020 our General Assembly elected the new ETN Board members for 2020-2022. As ETN's face-to-face AGM & Workshop was cancelled due to COVID-19, the ETN Board election was held online.

Pedro Lopez, Chief Operating Officer – Asset Operations within Uniper, was appointed as the Chairman and President of ETN by the newly elected ETN Board of Directors. He took over this role from the outgoing President Bernard Quoix (Total), who held this position for the past 10 years.

Pedro Lopez 1 will be supported by the Vice President Hege Rognø 2 (Equinor), and the Board members Walt Steimel 3 (Shell), Bram Van Cauwenberge 4 (Engie), Mick Conway 5 (RWG Repair & Overhauls), Andy Williams 6 (Chromalloy), Manfred Aigner 7 (DLR), John Oakey 8 (Cranfield University), Magnus Genrup 9 (Lund University) and Gary Lock 10 (Frazer-Nash Consultancy).

We would especially like to thank Bernard Quoix, ETN's outgoing President, and Cath Goy, our outgoing Vice President, for their leadership, valuable support and dedication to ETN and the industry over the past 10 years, as well as Aristide Massardo for his expertise and guidance during his term.

The ETN team is looking forward to working with the newly elected ETN Board who will hold their first teleconference meeting in mid-August. ■

"I feel honoured to succeed Bernard Quoix and very excited to have the opportunity to further develop ETN. The energy industry is facing a deep and accelerated transformation powered by megatrends like decarbonisation, digitalisation and decentralisation, but also profound developments in technology and a change in general public priorities. Under this context, associations like ETN are called to play a relevant role. I believe such energy transformation cannot be achieved by different individual players' efforts, but as a joint industry effort. ETN, an association which brings together the entire value chain of turbomachinery technology worldwide, can enable such industry coordinated effort and can support its associates to stay relevant during and after the energy transition."

Pedro Lopez, Uniper

OEM representation in the ETN Board

Based on the positive experience of having the Original Equipment Manufacturers (OEMs) in the ETN Project Board, the ETN Board recommended adding two Board seats for the OEMs, in order to have all the stakeholders represented. As the General Assembly has the power to decide on this matter, the ETN members were invited to cast their vote in conjunction with the ETN Board election.

ETN's outgoing President Bernard Quoix announced the results in his AGM opening speech: 86% of ETN members were in favour of adding two seats for the OEMs to the ETN Board. Bernard Quoix sincerely welcomed this development: *"First, when I became President of ETN in 2010, my main objectives were not only to strengthen the voice of the user community but also to involve all the stakeholders in order to create a better dialogue and understanding, and a closer cooperation between the user community, the research community, the OEMs as well as the suppliers and service providers for the benefit of the whole value chain."*

A call for OEM candidates will be launched in July 2020 and the election will take place in October 2020. ■

ETN Young Engineers Committee

ETN officially inaugurated its Young Engineers Commitee (YEC) on 30 June 2020. This committee is aligned with ETN's objective to enable further engagement of early-career engineers in projects of common interest in the energy transition field.

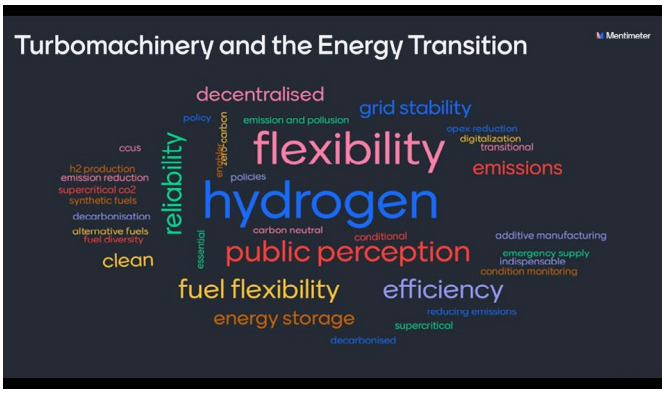
The YEC's vision is to bring together the future generation of engineers and leaders of ETN members and the wider energy sector, who are able to sketch pathways for a successful energy transition towards a carbon-neutral society. To materialise this vision, the YEC will act as a platform dedicated to promising early-career engineers from different ETN member organisations. It will provide them an opportunity to share experiences, develop skills, and build network, in order to provide valuable contributions supporting the development of low-carbon and carbon-neutral technology solutions.

Launch meeting and panel discussion

The Young Engineers Committee was introduced to the General Assembly at ETN's Virtual Annual General Meeting, and the YEC members presented and discussed more thoroughly the benefits that each organisation is expecting from this ETN initiative during a dedicated teleconference meeting on the following week.

The YEC inaugural group, currently composed of members representing 12 ETN member organisations, organised a two-part teleconference, with the first part consisting of an introduction to the initiative, strategy and plans for the future. YEC representatives presented their plans to prepare articles aligned with the objective of raising awareness on promising solutions and paths towards net-zero carbon emissions, and highlighted the first main collaborative YEC task: to draft a Strategic Paper on Energy Transition. Reaching net-zero emissions is an ambitious target requiring disruptive approaches, which YEC members would like to address with innovative ideas for a common goal.

During the meeting, audience input was collected on key considerations for turbomachinery in the energy transition. A word cloud was generated by the participants in real-time highlighting hydrogen, flexibility, public perception, and reliability among many interesting topics.



Second part of the meeting consisted of a panel discussion with ETN's Emeritus members and YEC representatives who shared their thoughts on the role of turbomachinery in the energy transition. The panel session was chaired by Jon Runyon (YEC member/Cardiff University). André Mom (ETN President Emeritus) started by sharing his view on the fundamental role of gas turbine technology in the future energy mix and the crucial impact hydrogen is expected to have across multiple sectors. Dieter Krapp (ETN Emeritus member) underlined the importance of keeping a global perspective, considering the forecasts highlighting that gas is expected to continue playing a major role worldwide until 2050, supporting the development of a low-carbon hydrogen economy.

Felix Heerbeck (YEC member/Uniper) shared his view on energy transition from a utility perspective, highlighting the increasing need for reliable back-up system due to a growing share of renewable energy sources in the energy system under transformation. Brandon Kemerling (YEC member/Solar Turbines) gave a presentation from an OEM's point of view, supporting the trends towards decarbonised power with hydrogen fuel, and highlighting the enabling capabilities of

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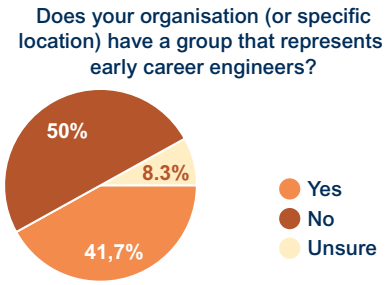
additive manufacturing used to expand component design capabilities and develop advanced solutions for arising challenges. Presentations from both parts of the meeting are available on ETN's website.

Support from ETN members – results of YEC survey

The Young Engineers Committee gathered feedback from ETN members through an online survey from April to June 2020. The YEC also gathered opinions on other topics, such as the energy transition and recruitment and retention, which the YEC will help to address within ETN.

As the YEC aims to provide a networking platform for future leaders in the turbomachinery field, respondents were asked whether their organisations provided an internal network for early-career engineers. As seen below, 50% of respondents indicated that they do not currently have a dedicated programme, a function which the YEC will help to provide, particularly for SMEs.

ETN members were asked for their views on what benefits the YEC could bring to young engineers in their organisations. Many responses highlighted the positive aspects of leadership development, networking and broadening industry exposure in the global context that ETN provides.



ETN members also provided their views on the opportunity for the YEC to help address the transition to a net-zero carbon energy system and the opportunity to incentivise retention of engineers within the turbomachinery field. Over 80% of respondents agreed that the YEC could contribute with fresh perspective and innovative ideas in the energy transition, in addition to their vested interest in the success of low-carbon technologies to mitigate climate change. Respondents emphasised low-carbon technologies such as hydrogen as a driver to encouraging young engineers into the turbomachinery field. This was captured particularly well by one survey respondent:

"It can sometimes be difficult for young engineers to foresee a future in gas turbines when the popular media cite wind and solar as the only solutions needed. The rising profile of hydrogen is beginning to change that perception, however."

This highlights potential cross-collaboration of YEC with ETN's Working Groups. These results further emphasise the important role that the YEC can play in changing perceptions about the turbomachinery field and supporting new developments to enable the transition to net-zero and beyond. ■

Results of the survey published by Jon Runyon, Cardiff University

Additive Manufacturing Equipment Evaluation Initiative

ETN's Additive Manufacturing Working Group held a teleconference meeting in May 2020 to discuss the launch of the new ETN initiative evaluating the capabilities of available AM machines based on the Laser Power Bed Fusion technology. As productivity and product quality levels that can be reached by additive manufacturing equipment are of particular interest to ETN members, the teleconference meeting was well-attended by participants from the whole value chain.

The three organisations forming the core team behind this initiative, Engie, Shell and Siemens, presented their draft proposal which would directly involve machine suppliers, and is particularly targeted at applications in the energy sector.

With the supporting feedback received during the meeting, the core team will now work on the clarifications required and initiate the process.

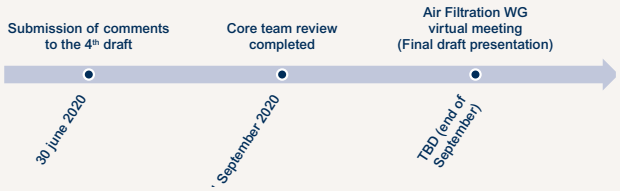
The Equipment Evaluation Initiative was also discussed during ETN's AGM & Workshop session "Additive manufacturing and new materials". Presentations and other AM Working Group documents are available for ETN members on our website. ■

Air Filtration Working Group

ETN's Air Filtration Working Group is working on the new version of the ETN Water/Salt test procedure related to the standard ISO 29461 – Part 5: Test methods for static filter systems in marine and offshore environments.

Instead of organising a face-to-face meeting, scheduled for March 2020, the WG members held a teleconference meeting in the beginning of March. After the meeting the Air Filtration WG's core group has continued to hold regular bi-weekly teleconferences to advance with the initiative. In early June 2020 the Working Group members were invited to review the 4th revision of the ETN draft water/salt test procedure and send their comments to the ETN office by the end of June 2020.

The timeline shows the preliminary schedule for the Working Group before the final draft is submitted to the ISO/TC 142 Committee.



Further information about ETN's Air Filtration Working Group can be found here. ■

Webinar on best practices for managing the COVID-19 crisis

Following discussions with our members, the ETN user community raised their interest to share best practices for operations and services related to protecting personnel from COVID-19. ETN organised a webinar "Best practices for managing the COVID-19 crisis from a H&S perspective" in the beginning of June 2020. All the webinar presentations are available for ETN members on our website. ■

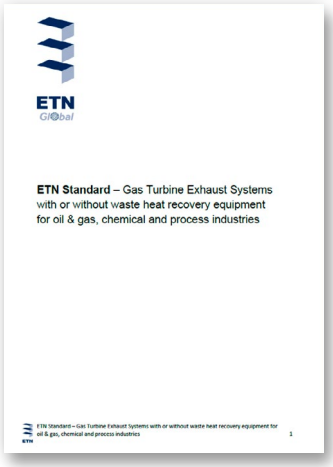
ETN's virtual User Group Meetings

ETN's LM2500 and SGT-A35 User Groups will see their annual meetings organised virtually in autumn 2020 in order to bridge the gap until it is safe again to hold face-to-face meetings.

ETN has decided to preserve the health and safety of all participants, while at the same time we want to answer to the request of involved stakeholders: to preserve a continuous and focused dialogue on prioritised topics to improve reliability, reduce risk and reduce operational costs for each engine family.

A shorter and more targeted agenda is being developed in collaboration with users, OEMs and selected independent service providers, addressing key topics raised by the two ETN user communities. More information will be available on ETN's website. ■

Exhaust Systems Working Group



Following the publication of the *"ISO 21905 – Gas turbine applications – Requirements for exhaust and heat recovery unit"*, the ETN Project Board has decided to launch a consultation among the ETN members in order to agree on the future activities of the ETN Exhaust Systems Working Group.

Since its set-up, the ETN Exhaust Systems Working Group has focused mainly on the development of the standard for the Waste Heat Recovery Unit, given the high interest showed by the ETN members. However a similar publication could be drafted on the Waste Heat Recovery Steam Generator. If your organisation would be keen to cooperate on this new publication, please contact the ETN office.

The standard *"ISO 21905:2020 Gas turbine exhaust systems with or without waste heat recovery"* was published by the ISO in March 2020, based on the work carried out by the ETN Exhaust Systems Working Group. ETN's press release about the ISO publication can be downloaded here. The ETN standard and other Exhaust Systems Working Group documents are available for ETN members on our website. ■

IGTC
International
Gas Turbine Conference

IGTC postponed to 2021

Due to the health risks associated with the COVID-19 pandemic, company travel bans, and the uncertainty if face-to-face events will be allowed, the Conference Advisory Board of our International Gas Turbine Conference (IGTC) has taken the decision to postpone the event. ETN's 10th IGTC "Gas turbines in a carbon-neutral society" will therefore take place on 12-13 October 2021, at the same venue (Le Plaza Hotel) in Brussels, Belgium.

All authors of the selected abstracts are automatically invited to re-submit their technical papers to our conference in 2021. Regular updates will be published on our IGTC webpage – stay tuned! ■

Educational courses

ETN is collecting information about technical gas turbine courses available, given by our members, in order to promote and share the knowledge and experience of our community. If your organisation would like to list some courses on our website, please contact us for more details.

Interview with Renzo Di Felice, University of Genoa, partner of new EU project FLEXnCONFU

The increasing share of fluctuating renewable energy sources (RES) into the electrical grid poses challenges related to grid stability. The FLEXnCONFU (FLEXibilize combined cycle power plant through Power-to-X solutions using non-CONventional fuels) project's main goal is to develop power-to-X-to-power solutions that, coupled with RES, can absorb the fluctuations, increasing greatly the flexibility of the grid. ETN interviewed Renzo Di Felice, Professor of Chemical Engineering from the University of Genoa, who is leading the demonstration activities on the power-to-ammonia solution that will be carried out at Savona Lab in Italy.

Could you tell us about University of Genoa's role in FLEXnCONFU?

University of Genoa's (UNIGE) contribution to FLEXnCONFU project is a joint effort between the Department of Civil, Chemical and Environmental Engineering, and the Department of Mechanical Engineering. Our departments have been collaborating for many years on the broad subject of energy systems.

UNIGE will supervise all the activities related to the power-to-ammonia-to-power (P2A2P) concept and will host the demonstrator at its laboratory, providing also the microturbine that will be properly modified to be fuelled with ammonia. A T100 machine will be available in a flexible test rig in the IES Lab, equipped with several sensors to perform the experimental activity.

UNIGE will be responsible for the installation, commissioning, and the test campaign of the integrated demo. The P2A2P plant is the integration of two different complementary systems to improve the flexibility of the grid. On one side, the innovative, highly flexible, and modular P2A system, designed for small-scale distributed applications, converts the electrical energy surplus into ammonia that can be stored. On the other side, the A2P system uses the stored ammonia to produce electrical energy when required.

The P2A system will be designed and developed in a modular containerised solution that will be installed at the UNIGE IES Lab. The modified T100 microturbine will also be equipped with a NO_x detector to evaluate the system performance in terms of emission. The IES Lab is the proper environment to test the performance and the potentiality of the P2A2P solution due to the rig flexibility, and the possible integration with the existing infrastructure (i.e. the smart poly-generation grid of the Savona campus).

What are the advantages of the power-to-ammonia solution?

Energy production from renewable sources, such as solar and wind, is highly variable with time, and it is extremely unlikely that its production curve would correspond with demand. Therefore, accumulation is necessary. Power-to-ammonia solution tries to address this fundamental problem by using renewable electricity to produce ammonia, which then can be easily stored and utilised afterwards when needed. Ammonia is an ideal storage solution for energy, as it can be stored in liquid state at ambient temperature for modest pressure (of the order of 1 MPa) with a density of 610 kg/m^3. The correspondent energy volumetric density of 15.6 GJ/m^3, which is 70% more than liquid hydrogen (9.1 GJ/m^3 at cryogenic temperature) or almost three times more than compressed hydrogen (5.6 GJ/m^3 at 70 MPa).

Moreover, ammonia is an effective hydrogen storage medium: 1 m^3 of liquid ammonia (at 240K) contains about 120kg of H_2. Ammonia, being a fuel, is a flammable gas, but the risk of fire is lower compared to other fuels since the flammability limit is small and the condition for ignition, spontaneous ignition temperature, and minimum ignition energy, are difficult.

Savona Lab, Italy

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Interview with Renzo Di Felice

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What is the technology behind the power-to-ammonia solution?

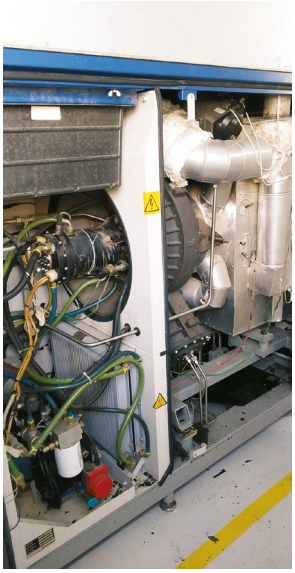
Ammonia has been produced industrially for more than one hundred years now, since the introduction of the Haber process in 1913, by chemically combining hydrogen and nitrogen. In the Haber process, the reactants are fed to a catalytic fixed bed reactor, with the catalyst made up mainly of iron and some promoters such potassium hydroxide, at elevated pressure (up to several hundred atmospheres) and temperature (400-500 °C). Today, world production of ammonia is of the order of 200 million ton/year, with some 80% of it utilised as base for agricultural fertiliser. With such a large output, it is understandable that the ammonia production technology has been refined and improved over the years with the objective of increasing efficiency and minimising environmental impact, and therefore we can safely assume that a vast body of knowledge is at our disposal so that the best available solution can be chosen for our specific application.

On the other hand, technological advancements in ammonia production have gone in the direction of addressing the implementation of very large plants, capable of producing 1 M ton/year and constantly operating at nominal load, whereas in the present power-to-ammonia solution applied in combined cycle power plants, the desired output is orders of magnitude smaller and the high operating flexibility and rapid responsiveness are two of the major requirements to be able to follow the CC plant production fluctuation. Moreover, in the present application hydrogen would not be produced from fossil fuel but from electricity, with obvious consequences on the overall process conception.

Which research activities will be carried out in FLEXnCONFU related to the power-to-ammonia solution?

The overall process will produce ammonia, and oxygen as by-product, starting from a water electrolyser that, absorbing electrical energy, splits the water molecule into hydrogen and oxygen. The research activities will concentrate on the innovative aspects of the power to ammonia solution and its integration with CC power plant. Of fundamental importance will be for example to study the hydrolyser performance where the first step of the process is carried out. Regarding the actual ammonia production, the first objective will be the selection of the best catalyst that, at affordable cost, will guarantee a reasonable amount of productivity. The search of the optimum process conditions, temperature and pressure, will also be targeted for small-scale application, very much different from the industrial installation existing worldwide.

Another fundamental characteristic to be considered will be how the overall process will respond at variable loading. As no hydrogen accumulation is foreseen, not here nor in future industrial installations, as it would not be economically sustainable, it must be fed to the system at whatever rate is produced in the electrolyser. Therefore the ammonia reactor must be capable of satisfactorily working at variable feed flow rates and specific investigation is needed to address this problem. Moreover, the modular P2A solution will be developed inside a portable container to be suitable to transport and install. From the A2P side, an innovative ammonia combustion chamber will be developed and installed in a modified mGT to close the loop and test the mGT performance both in terms of fuel consumption and emissions.



Savona Lab, Italy

What are the Key Performance Indicators of the power-to-ammonia solution and the targets to be achieved?

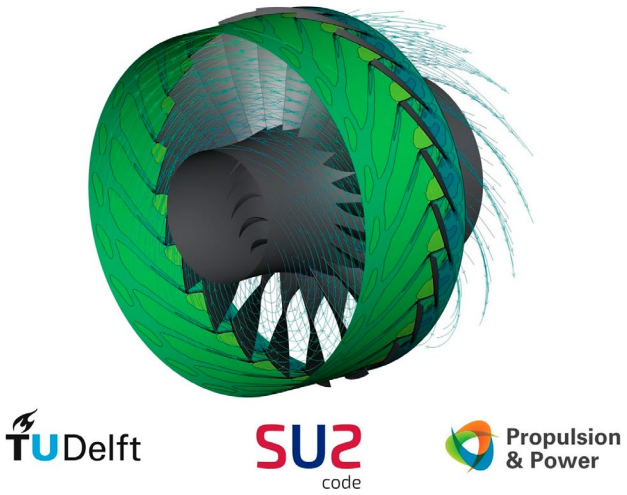
Any transformation process comes with a penalty, and this one is not an exception. Keeping the price to pay at a minimum is of paramount importance. The first Key Performance Indicator is the energy efficiency of the overall process, which will take into consideration the efficiency of transforming electricity into hydrogen, and then hydrogen into ammonia. Today ammonia production from fossil fuel can be carried out in the most energy-efficient process with an energy expenditure as low as 28 GJ/t, although figures in the region of 40 GJ/t are most common in existing plants around the world.

On the other hand, this number must be evaluated in the wider framework and objectives of the FLEXnCONFU project, i.e the improvement of the power plant flexibility in terms of MEL, Load gradient, and EOH, together with the reduction of fossil fuel combustion and related emissions. It is hoped, for example, thanks to the integration of the P2P layout, that for each CC power plant (400 MW reference) can obtain a yearly saving of 15000 t of NG and it can avoid 100000 tCO_2 emissions. A yearly emission saving of 2500 kg of CO, 5000 kg of NO_x (thanks to enhanced $DENO_x$ solutions), 200 kg of SOx and 5000 kg of particulate can be also estimated.

ETN is a partner of FLEXnCONFU, a four-year project with a total budget of 12.6 million euros that brings together the entire supply chain of centralised power generation, involving ETN members RINA Consulting, Baker Hughes, Cardiff University, CERTH, Eindhoven University of Technology, ENGIE Laborelec, KTH and University of Genoa. Check out the new FLEXnCONFU website and follow the project developments on LinkedIn and Twitter. ■

Design innovation for power OEMs: SU2 multidisciplinary open source software

Not only a novel turbomachinery simulation and design program for disruptive innovation but a collaborative R&D framework.



Steady-state RANS simulation of the NASA Rotor 67 at nominal operating conditions

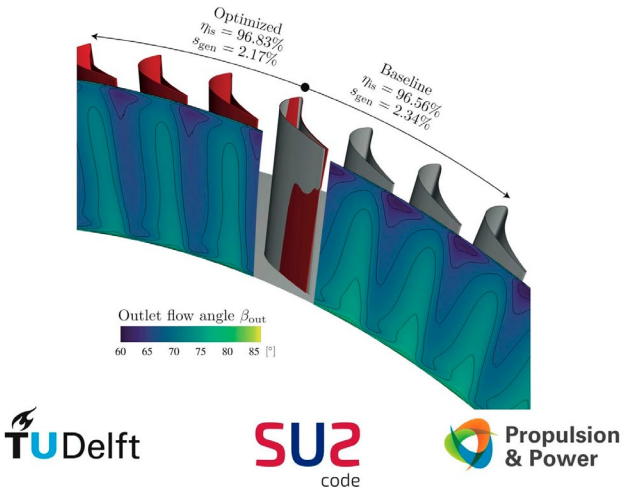
The design and verification process of turbomachinery is often rather consolidated, therefore testing or introducing novel and potentially disruptive methodologies can prove hard. The SU2 software framework is proposed as a multidisciplinary tool for the exploration of new or radically new solutions which can be quickly identified, thanks to its flexible and efficient optimisation capabilities.

Apart from its disruptive features, SU2 is a collaborative platform, a new "business model" founded on the open science and open source paradigm to increase the pace of innovation. It is professionally maintained by the SU2 Foundation and, thanks to the GNU Lesser General Public License, anyone including commercial entities can use it for free and modify it with custom features and proprietary knowledge, but the resulting code can be kept confidential. The underlying idea is that more effective development arises from collaboration with academic groups, as often customary, but within a larger and prestigious community, and professional framework, providing companies with access to the best expertise in many areas and to top talent.

The SU2 software platform originated in 2012 as a small initiative within the Aerospace Design Lab of Stanford University (US) and it has now organically grown to an international open source project, with involvement from dozens of high-profile organisations, hundreds of developers, and thousands of users. The unique distinguishing feature of the code is that it was conceived from the start as a multi-disciplinary design tool, capable of solving the most demanding problems, with hundreds of design variables and multiple constraints, thanks to the embedded adjoint-based optimisation capabilities.

The SU2 Foundation was incorporated in the US in May 2019. The Propulsion and Power (P&P) group of Delft University of Technology (the Netherlands) joined the effort in 2014, by taking the lead in the development of the turbomachinery features. The turbomachinery design tool of SU2 has been validated using a variety of well documented test cases. Moreover, a first of its-kind validation was carried on by comparing the calculated performance of a high speed organic Rankine cycle turbine against experimental data. The SU2 tool has then been used to solve extremely demanding fluid dynamic shape optimisation problems, both steady state and unsteady, thanks to its distinctive Harmonic Balance solver, also developed by the P&P group as a result of several research projects in collaboration with global companies. The solver and the optimiser can handle design problems involving complex flow physics, like condensing and non-ideal flows, namely flows of fluids whose properties depart significantly from those prescribed by the ideal gas law. Furthermore, the P&P group recently made available open-source ParaBlade, the first version of a CAD based parametrisation tool for highly constrained turbomachinery optimisation. The latest SU2 development has been focused on aero-structural blade optimisation, and a group of the Imperial College London (UK) recently joined in this effort.

The first SU2 International Conference took place online on 10-12 June 2020, with 200 attendees from all over the world. All presentations and talks are available on the 1st Global SU2 Conference website. Various turbomachinery features of SU2 will be demonstrated also at the Virtual ASME Turbo Expo 2020 during the Tutorial Session titled "Adjoint-based Turbomachinery Shape Optimization: Basic Concepts, Challenges and Applications". ■



Validated full-3D adjoint-based shape optimisation of the Aachen Stator using a CAD-based parametrisation

EU Commission's hydrogen strategy published

Earlier this year the European Commission launched a public consultation on the EU's planned strategy on hydrogen, seeking to explore the potential of clean hydrogen to help decarbonising the economy in a cost-effective way, in line with the EU's 2050 climate neutrality goal. In response to this consultation ETN's Hydrogen Working Group submitted a position paper to the European Commission.

In a communication to the EU institutions the European Commission presented this month its proposed strategy for future energy systems and clean hydrogen. With the title "Powering a climate-neutral economy" the EU strategy for energy system integration aims to provide the framework for the green energy transition, meaning that the energy system would be "planned and operated as a whole, linking different energy carriers, infrastructures, and consumption sectors". Its key elements are a more "circular" energy system, emphasising energy efficiency; a greater direct electrification of end-use sectors, such as transport and buildings; and the use of renewable and low-carbon fuels, including hydrogen. The publication does not include legislative proposals, but some of the existing EU climate legislation will be revised by June 2021.

The EU Hydrogen Strategy complements the energy system integration plans and addresses how to transform the potential of hydrogen into reality, through investments, regulation, market creation and research and innovation. Hydrogen is currently a hot topic in Europe, and Frans Timmermans, Executive Vice-President of the European Commission in charge of the European Green Deal, and a strong advocate of hydrogen, has highlighted Europe's potential role as a world leader in hydrogen technologies: *"With the state of technology in Europe, the economics, and the policy instruments at hand, the European Union can take the lead globally. I believe there is so traction for this, this has become the rock star for new energies all across the world, especially in Europe"*, Timmermans said in a press conference in July.

In order to "capitalise on the investment plans in the hydrogen strategy", the European Commission launched also the European Clean Hydrogen Alliance. This alliance, which brings together industry, national and local public authorities, civil society and other stakeholders, aims to establish an investment agenda and support the scaling up of the hydrogen value chain across Europe. It is open to all public and private actors with activities for renewable or low-carbon hydrogen. ■

SUSTAINABLE ENERGY WEEK
An initiative of the European Commission

EU Sustainable Energy Week session

"Energy Efficiency – Unlocking the Potential of Unused Heat & Cold in Industry"

ETN co-organised the webinar "Energy Efficiency – Unlocking the Potential of Unused Heat & Cold in Industry" on 26 June 2020 together with EUTurbines, A SPIRE and the EU SET Plan Action 6 Secretariat, as part of the EU Sustainable Energy Week. In line with discussions on Heat and Cold in the EU Strategic Energy Technology (SET) Plan Action 6, which aims at "making EU industry less energy and resources intensive, more carbon-neutral and competitive", the webinar addressed the potential of heat-to-power solutions and discussed how improved industrial energy efficiency contributes to the EU's energy and climate targets. Presentations are now available on ETN's website. Full recording of the webinar can be accessed here. ■

ETIP SNET
EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM
SMART NETWORKS FOR ENERGY TRANSITION

New ETIP SNET publications

The European Technology and Innovation Platform Smart Networks for Energy Transition (ETIP SNET) published its R&I Implementation Plan 2021- 2024. This publication addresses short-term key research and innovation priorities and budget estimate needed for the next 4 years to help to achieve the energy sector's long-term carbon-neutral goals by 2050. The full document can be accessed here.

ETIP SNET also released an updated version of its R&I Roadmap 2020 – 2030 in June. The report provides a system view to the entire energy transition by addressing a scope with smart electricity grids as its backbone, as well as encompasses interactions with the gas and heat networks and focuses on integration of all flexibility solutions into the power system, including energy storage technologies. If you have not read this report yet, you can download a copy here. ■

Upcoming meetings and events

Meeting/Event	Date	Location
ETN LM2500 User Group Meeting	Autumn 2020	Virtual meeting
ETN SGT-A35 User Group Meeting	Autumn 2020	Virtual meeting
ETN High-Level User Meeting	13 October 2020	Virtual meeting
Report from the High-Level User Meeting	14 October 2020	Virtual meeting
ETN's 10th International Gas Turbine Conference	12-13 October 2021	Brussels, Belgium

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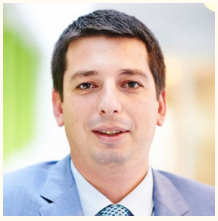

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ETN at a Glance!

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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