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.

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Christer Björkqvist
Managing Director

The importance of a holistic and resilient energy system

The current European energy crisis clearly demonstrates that the energy policy trilemma of achieving affordable, reliable, and environmentally sustainable supply is still to be solved.

It also provides a lesson of importance to have a resilient interconnected energy system with reliable dispatchable energy and storage solutions in place, to offset the intermittency of renewable energy before any major energy transition steps are taken. Without such policy and technology in place, price volatility and blackouts are likely to become a frequent occurrence.

As coal plants and, in some countries, nuclear plants are gradually phased out in favour of renewable power, IEA predicts, in its latest global report, that renewable electricity capacity growth will reach a staggering 4800 GW by 2026, which is equal to the current global power capacity of fossil fuels and nuclear power combined.

With such an amount of weather dependent renewables in the energy mix one can imagine the consequences if similar energy crisis triggering causes would happen, with an exceptional cold winter and an unexpected seasonal low wind power production. Hopefully politicians have learnt a lesson.
At least the European Commission's Taxonomy proposal, currently under a final review, suggests that it is the case. In the proposal natural gas will be seen as a "green" investment for a certain period in the energy transition to incentivise a shift from coal to gas and then gradually a shift to an increasing percentage of low carbon and carbon free fuels.

Through a proactive approach our gas turbine community can provide a valuable contribution to a resilient energy system by developing and offering a portfolio of efficient and dispatchable generation solutions for a wide range of applications across many sectors. Energy efficiency and waste measures, fuel switching and storage solutions including CCUS are all priorities highlighted at ETN's High Level User meeting in 2021. We carefully need to follow up on these topics and develop our own ETN roadmap.

To facilitate the advancement and implementation of such an approach I am pleased to announce that ETN is in full preparation for a transition to long-awaited face-to-face meetings without putting safety aspect aside. The first in person meeting will be ETN's Annual General Meeting and Workshop that will take place 29-30 March in Brussels where you will be provided with the latest policy, market, and technology updates. We hope to see as many of our members as possible in person to discuss how to influence and position ourselves best in the current energy transition and how our community can accelerate technology developments in a proactive way to ensure a wide contribution to a holistic and resilient energy system.

Looking forward to a good and successful cooperation in 2022!

ETN's Annual General Meeting and Workshop

ETN's Annual General Meeting (AGM) and Workshop will be held in Brussels on 29 and 30 March 2022.

This will be ETN's first major event in 2022 and a first face-to-face meeting. We hope for ease of travel restrictions across our community but will also provide the opportunity for virtual participation.

We would like to ensure all the participants who will join us in person that ETN will take all the necessary precautions to comply with COVID-19 measures, set out by the Belgian government, to minimize any risk for infections.

Programme

The programme is as follows:

- 29 March: AGM (13:00-17:30 CET)
- 30 March: Workshop with 2 parallel sessions (08:00 - 16:00 CET)

Sponsorship and exhibition opportunity

This ETN 2-day event brings together representants from the whole gas turbine (GT) community. It is not only an opportunity to receive the annual activities' update, but also the 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 GT experts.

ETN will be offering sponsorship and exhibition opportunities for this event. If you are interested in becoming a sponsor or an exhibitor, please contact us and we will provide you the necessary information.

Venue and registrations

The venue for the event will be confirmed shortly and registrations will open beginning of February.

For more information, please check our event website. ■

ETN President's annual message to the members

ETN President Pedro Lopez highlighted in his letter (login required) to the members dated 26 November 2021 ETN's achievements in 2021 and plans for 2022. He noted a busy year with many on-going activities, such as continued work within ETN's Working Groups, Engine-Specific User Groups, and R&D projects, as well as several successful virtual events and webinars, all of which enabled knowledge sharing and providing networking opportunities for ETN's members.

The President also emphasised ETN's strength and ability to develop a portfolio of solutions because of its close relationship with both the user community and the policymakers. Key objectives for 2022 are to further strengthen these relationships, expand the user community and ensure users active involvement in ETN. The organisation has prepared a versatile programme of activities with virtual, physical and hybrid events in 2022. Please find ETN's calendar here. ■

New member

Universitetet i Stavanger

We warmly welcome The University of Stavanger (Norway) who joined ETN.

The University of Stavanger (UiS) has about 12,000 students and 1,900 employees (about 10 staff members are working in the fields related to gas turbine/turbomachinery technology). In constant collaboration and dialogue with its surroundings, regionally, nationally, and internationally, UiS enjoys an open and creative climate for education, research, innovation, dissemination, and museum activities. The university has two micro gas turbines, each one with 100 kWel output (based on Turbec T100 or Ansaldo Energia AE-T100), that are used for performing active research and development within testing fuel flexibility and use of other fuels than natural gas, such as hydrogen or biogas. ■

ETN's Working Groups

Currently ETN has the following active Working Groups (WGs) which allow key stakeholders within the gas turbine community to discuss topics and challenges of common interest through projects:

- Air Filtration
- Additive Manufacturing
- Exhaust Systems
- Hydrogen
- Decentralised Energy Systems
- Supercritical CO_2 (sCO_2)

Follow the links above to each of the 6 WGs and find the objectives, partners and lead contacts, latest developments (login required), relevant documentation (login required), list of members (login required) as well as a list of events.

To join a WG of your interest please send us an email (note that you have to be an ETN member). Not a member yet and you would like to know the benefits that ETN membership can offer, please follow this link. ■

Educational courses

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

ASME Turbo Expo 2022

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

ETN's Managing Director Christer Björkqvist will be the Executive Conference Chair and will co-moderate the keynote session *"Road-Mapping the Future of Propulsion and Power"* to be held on 13 June 2022.

ETN members are entitled to a 15% discounted registration fee for the conference. For more details, please contact the ETN office. ■

Interview with CO2OLHEAT project partners

Ambra Giovannelli, Assistant Professor of Fluid Machinery and Energy Conversion Systems (Roma Tre University) and Matteo Baggiani, Business Unit Manager (SimeROM)

Ambra Giovannelli

Matteo Baggiani

CO2OLHEAT is an EU H2020 funded project demonstrated at a high Technology Readiness Level (TRL 7) in a CEMEX cement plant in Prachovice, Czech Republic. It aims at addressing energy efficiency challenges and decarbonisation in resource and energy intensive industries. The idea is to unlock the potential of industrial waste heat and transform it into electricity via supercritical CO_2 power (sCO_2) cycles. The plant will generate clean energy while saving significant amount of primary energy and thus also CO_2 emissions. This is the first-of-its-kind Waste Heat Recovery (WHR) sCO_2 plant set into a real industrial environment.

What is your role in the project?

Ambra: ROMA3 covers the modelling activities related to the CEMEX demo plant. This means a definition of the overall waste heat recovery system layout and its integration in the existing cement plant facility. It also includes the demo cycle modelling and optimisation from the thermodynamic and economic point of view. There are also other partners involved in this work package because we need many diverse skills to manage all the activities.

Matteo: SimeROM is an engineering and construction company. Its role in the project will be to prefabricate Power-Cycle Independent Modules in our workshops, assemble, and install them in the CEMEX demonstration plant in Prachovice. This is an essential task in the project as the modules represent a full-scale prototype. To have it installed and make it work in a real industrial plant environment is a big challenge but also a big advantage of this project. We are not talking here only about R&D, but about an actual demonstration.

What is the biggest added value of your organisation and your major takeaway from the project?

Ambra: Our research group has been applying thermodynamic and economic models in innovative power systems for almost 15 years. We have also been focusing on storage (e.g. compressed air) systems in the last years too. Additionally, the group has been involved in several national and European projects dealing with innovative gas turbines (rich hydrogen gases, solar turbines), as well as with supercritical and trans-critical CO_2 cycles. Therefore, we are very well equipped to provide a valuable theoretical contribution. This project will allow us to "jump" to another level of understanding the behaviour of the whole innovative sCO_2 system, and specifically, of the individual components. This novel technology is a major step forward and new to all of us.

Matteo: As we are a modular Engineering, Procurement & Construction (EPC) company, we have to ensure that the CO2OLHEAT plant can be easily replicable. Making it modular means to make it flexible in terms of installation and to have it installed fast – like a "plug-and-play" system. This is what we will bring to the project. At the same time, we will greatly benefit from the opportunity to be able to actually use the supercritical CO_2, and do it economically. This will give us a competitive advantage. Having the sCO_2-related competencies is a must for an EPC contractor of our type. Receiving the opportunity to work in this new field is priceless.

How could you describe the impact of the project for the future?

Ambra: CO2OLHEAT can be a breakthrough, very relevant in the power energy sector. The sCO_2 systems are expected to be efficient, flexible, and perhaps less costly than some other conventional waste heat recovery plants. For example, traditional WHR systems based on Organic Rankine Cycle (ORC) technology are rather costly, having a long pay-back period. Thus, their exploitation is quite limited in Europe and

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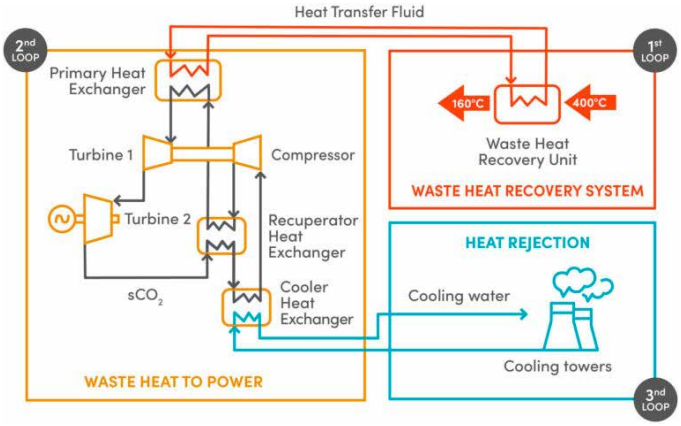
the US, and therefore are mostly deployed in Asia, where the manufacturing costs are lower. The high price tag of ORC WHR systems represents a serious bottleneck that can provide an opportunity for the sCO_2 WHR systems, as they could mitigate this obstacle.

Matteo: Allow me to be a bit philosophical on this question. I believe that recently, the human community have had a couple of important enemies. One of them is Covid-19. The other one is waste – carbon dioxide emissions, to be specific. This is currently the biggest enemy of the climate and human beings. I think that the only way to beat it is finding means to give importance to the waste, by the employment of new technologies. This project will be crucial in this respect because it provides a potential use of carbon dioxide. Obviously, we will not use a lot of it in our project (laughs). Anyway, we will use the CO_2 as a working fluid (note that this is a very peculiar molecule, moreover in its supercritical state) and we will also recover the waste heat – and as a matter of fact, this is also CO_2. Having said all this, my answer is clear: we will use the waste to recover the waste. Isn't this fascinating?

How do you perceive the very high expectations from the CO2OLHEAT project and the fact that it is in the spotlight of the whole sCO_2 community? Does it give you extra energy into your work?

Ambra: There are other projects at high Technology Readiness Level (TRL), not only in Europe but also in the US and China. They are all expected to boost the introduction of this novel technology in the market in a short time and help the energy sector to become more environment friendly. If this project is successful, it will open the way for the sCO_2 technology in so many other sectors and could provide a great contribution to a green power sector. I find this absolutely exciting!

Matteo: This field has already been explored before. However, we are doing a full-scale prototype using many new technologies. It is not merely about using the sCO_2. It is also redesigning all the equipment. We must also consider the nature of the cement-production environment – a very tough one. Being the centre of attention in this EU-funded project and cooperating with other partners, active also in other European projects, bring shared discoveries. Being in this spotlight enables us to find better and faster the right technology and progress to have the plant ready. We are a mixed Romanian-Italian team, with a similar temperament; together, we are very passionate about what we are doing. ■



CO2OLHEAT's WH2P application is based on a recuperated closed-loop Brayton cycle with sCO2 as a working fluid

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Interview with FLEXnCONFU project partner

Rob Bastiaans, Eindhoven University of Technology (TU/e)

Rob Bastiaans

Increasing the fuel flexibility to carbon-neutral fuels and energy storage could be sustainable solutions as resilience against future energy crunches. ETN caught up with Rob Bastiaans, Associate Professor, Power & Flow group at TU/e, with whom we discussed TU/e's involvement in the FLEXnCONFU project.

What is TU/e's role in the FLEXnCONFU project?

TU/e is responsible for adding affordable accurate methods for Computational Fluid Dynamics (CFD) of the combustion process giving the opportunity to study parameter optimizations from a relatively cheap method comparing to the carrying out of experiments. In order to do so we start with generating a database based on Direct Numerical Simulation (DNS) for validation of acquired methods. We will then reduce the kinetics using Flamelet Generated Manifolds (FGM). After that we will derive and select the best method for doing Large Eddy Simulation (LES) (combined with FGM). Our philosophy is to start from the "truth" and incrementally allowing for validation of associated approximations of both the chemistry and the interaction with turbulence individually.

Why did TU/e join the FLEXnCONFU consortium?

As an academic research group at TU/e we did fundamental combustion (both experimental and theoretical) research and combined that with CFD technology for gas turbines for many years. Few years ago, we identified the very promising use of ammonia as a carbon-free fuel.

Expending the fuel flexibility of the combined cycle gas turbine seems to be a crucial element in the FLEXnCONFU project. How will TU/e address it?

Fuel flexibility is indeed a prime driver for the FLEXnCONFU project. Let me explain why. Hydrogen burns much quicker than natural gas, which can enhance the stability of the turbulent combustion. On the other hand, when ammonia is concerned, the opposite happens, and current gas turbines might not be able to accommodate large amounts of ammonia without redesigning the complete combustion chamber. However, we found in literature that a suitable mixture of the two can lead to methane (the primary component of natural gas) equivalent combustion properties that are even more robust. So, this potentially might allow for minimal design changes from a combustion perspective. This DNS was conducted by a respectable (mutually) research group.

What will be the next steps in the coming months?

Over the next months, our team is going to focus on the kinetic reduction part. In parallel we will look already to the possibility of implementing LES methods to identify the most promising approach in this respect.

What is most important for a successful decarbonisation process?

Concerning power and heat production, required transitions are severe, both technologically but also in mindset. To mitigate global warming, a very large range of solutions is required, going from energy savings to alternative green fuels and to energy storage concepts. We have the opinion that 'one size fits all' doesn't hold, especially if we look to a wider range of size and applications for generating power and heat. We think that providing the supply chain is most critical to attain progress in commercial proliferation. ■

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Interview with Robinson project partners

Simon Gianordoli, Project Officer at ETN, and Desislava Todorova, Researcher at Environmental Research Institute

Simon Gianordoli

Desislava Todorova

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

What is the Islands Energy Forum?

The Islands Energy Forum is a platform created at the earlier stages of the ROBINSON project. It gathers islands representatives from within and outside the EU. The Forum promotes cooperation and discussions about decarbonisation challenges for islands. As they are specific territories and are particularly threatened by climate change, reducing the energy dependence from the mainland and the implementation of clean energy solutions are vital objectives for them.

What are the goals of the Forum?

The Forum follows the guidelines of the Clean Energy for EU Islands Initiative to help islands in launching their decarbonisation process. This Initiative launched by the European Commission intends to provide technical support to islands in drafting their Clean Energy Transition Agenda (CETA). CETA represents a complete roadmap for decarbonisation decided by an Energy Transition Team, representing all valuable islands stakeholders of an island or a group of islands. The Forum is the place where we can work on challenges and obstacles encountered by the islands' representatives during this process, invite stakeholders to the Forum to share their energy solutions and increase the visibility and the business modelling process of the ROBINSON project.

What are the main challenges for the decarbonisation of islands?

Islands face many challenges in their path to decarbonisation such as legal and regulatory aspects in the energy landscape (connection to the grid, energy production, technology ownership…). The concrete implementation of technologies would represent an issue as well. ROBINSON chose an advanced gas turbine for a Combined Heat Power system with a complete set of interconnected technologies for its Demo Island, but each island would opt for the most suitable mix of technologies considering local factors: weather conditions, grid connection with the mainland, energy demand etc.

Moreover, the commitment of local authorities is key in establishing a CETA. However, some islands find these authorities to be reluctant at times to commit to this process. Finally, the lack of local skills in the technology field can restrain the process. Expertise and talent must be attracted and kept on the islands to build new energy solutions. The Forum intends to face those challenges together with the islands involved.

What will be the next steps in the coming months?

We will carry on helping the islands to draft their CETA by providing technical support from ROBINSON. The islands experience will be used and processed in designing ROBINSON business models. The Forum will of course continue to bring together new islands and stakeholders to join to increase links with related projects.

Any last comments?

It is very exciting to work on islands decarbonisation. Those territories are in a specific situation. Meeting green objectives and providing clean energy systems for islands is essential as they are at the frontline and are particularly vulnerable to the consequences of climate change. From a ROBINSON perspective, we assess different technologies in an energy management process that can be utilised by other islands. The Islands Energy Forum experience and lessons learnt will be reported after summer 2022. ■

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Prime movers' group on gas quality and hydrogen handling

In December 2020, the European Network of Transmission System Operators for Gas (ENTSOG), together with several Distribution System Operator (DSO) organisations, established a dedicated prime movers' group to find a systematic approach to decarbonise the gas grid in a cost-effective manner.

The aim is to collaborate on the main principles to handle gas quality related to renewable, decarbonised and low-carbon gases that can optimise the diversification of supplies, decarbonisation of the grid and guarantee end-user safety and access to the product they require. A more detailed description can be found here.

Most recently ETN attended a virtual workshop, which was held on 25 November 2021 (please find a detailed presentation here). It was split into 3 sessions addressing the following topics:

1. Gas system operators
2. Hydrogen users and producers
3. R&D, standardisation and hydrogen integration

Gas system operators highlighted that to integrate hydrogen into existing gas infrastructure, new acceptance criteria might be needed for materials used in storage as well as pipeline facilities. This would potentially lead to investments to renew or to modify current infrastructures.

Hydrogen producers indicated that, firstly, hydrogen as well as low carbon gases could be blended on the conditions that there is either a dedicated outlet or it could be blended downstream of the injection point. Secondly, it was concluded that carbon capture, utilisation and storage (CCUS) facilities could play an important role in the expansion of the hydrogen market as well as become a low-cost option when used to retrofit the existing hydrogen producing facilities.

From the hydrogen users' side, the most pressing issue is a need for defining the minimum quality standard for hydrogen to be injected into the grid. Without it, they warned that gas quality variations could be significant. There is however a common understanding that some industries can handle gas quality variations to a different extent, but far from all. Hence this issue might need to be tailored to specific needs of selected industries.

The power plant industry representatives pointed out that existing power plants can operate with a certain percentage of hydrogen. However, an assessment needs to be done considering each plants' unique circumstances and features.

Regarding new plants, industry representatives emphasised their technical readiness to begin their operations on natural gas and later switch to hydrogen.

A common acknowledgement from the Workshops participants highlighted the importance of collaboration between all organisations to provide an efficient work without replication.

Although this is an EU-based group, the work carried out by the network could be of potential interest globally due to common topics and discussions, such as the development of innovative and feasible ways to handle gas quality in fluctuating blends and pure hydrogen grids in future gas system as well as the main technical challenges associated with that.

For continuous work and updates from this group, please check their website. ETN Global will continue following the group and sharing relevant updates with our members. ■

@Image courtesy: REN Gasoduto

EU Taxonomy – a draft Complementary Delegated Act recognises natural gas as sustainable

On 31 December 2021, the European Commission launched a consultation with the Member States Expert Group on Sustainable Finance and the Platform on Sustainable Finance on a draft text of Taxonomy Complementary Delegated Act covering selected gas and nuclear activities, running until 21 January 2022.

The draft text brings good news for the gas turbine community, in line with the ETN's open letter to the European Commission from 21 December 2021, underlining the importance of including natural gas into the EU Taxonomy framework. The draft labels investments in natural gas power plants green under certain conditions, and on the grounds that they are "transitional activities", supporting the transition towards a predominantly renewable-based future.

The draft recognises three transitional activities: (1) Electricity generation from fossil gaseous fuels, (2) High-efficiency co-generation of heat/cool and power from fossil gaseous fuels, and (3) Production of heat/cool from fossil gaseous fuels in an efficient district heating and cooling system.

The power plants using natural gas must either emit less than 100g of CO_2e/kWh, with no sunset clause. In other words, no revision of this limit over time; should they exceed this limit then they must fulfil additional criteria and be subject to a sunset clause by 2030.

More specifically, exceeding the threshold of 100g of CO_2e/kWh, the facility's construction permit must be granted by 31 December 2030, the facility must replace a power plant based on traditional fossil fuels such as coal, and the replacement must lead to a reduction in emissions of at least 55% GHG per kWh of output energy. There are two alternative emissions limits: either (i) based on a direct carbon emission cap of 270g of CO_2e/kWh, or (ii) based on an annual carbon budget of 550kg of CO_2e/kW averaged over 20 years. Both limits will be reviewed every 3 years.

Moreover, the facility should demonstrate compatibility with low carbon gaseous fuels, and there should be effective plans or commitments to use at least 30% of renewable or low-carbon gases as of 1 January 2026, at least 55% as of 1 January 2030, towards a full switch by 31 December 2035.

These proposals offer new opportunities for an explicit recognition of the important role that gas turbines can play in the energy transformation process. ETN Global will continue supporting its members in increasing their capacity to scale up and accelerate their efforts to meet these ambitious goals and thus provide a wide contribution in the global decarbonisation. ■

Upcoming meetings and events

Meeting/Event	Date	Location
ETN Board meeting	15 February 2022	Virtual
ETN Project Board meeting	29 March 2022	Brussels, Belgium
ETN Board meeting	29 March 2022	Brussels, Belgium
Annual General Meeting & Workshop**	29-30 March 2022	Brussels, Belgium (hybrid event)
SGT-A35 User Group Meeting	Last week in April 2022	Stavanger, Norway
LM2500 User Group Meeting	7-9 June 2022	Aberdeen, Scotland
ASME Turbo Expo 2022*	13-17 June 2022	Rotterdam, the Netherlands
High-Level User Meeting	October 2022	Tbc
October Workshop	Week 41 October 2022	Tbc

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

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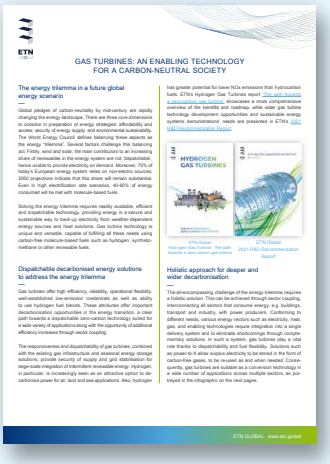
Keep in contact and updated with ETN's most recent news. Follow ETN on Twitter: @etngasturbine and on LinkedIn!

ETN at a Glance!

Download our publication "Gas turbines: an enabling technology for a carbon-neutral society" here and read more about ETN's vision.



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Download the one-pager showcasing the benefits of being part of ETN's global turbomachinery community.

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