ETN NEWS

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ETN is a non-profit association bringing together the entire value chain of the gas turbine technology community in Europe. Through the cooperative efforts of our members, ETN facilitates gas turbine research and technology development, promoting environmentally friendly stationary gas turbine technology with reliable and low cost operation.

In this issue

Christer Björkqvist
Managing Director

A unified EU energy policy at European level is higher on the political agenda than ever.

It will be interesting to see if Jean-Claude Juncker, the new president of the European Commission (EC), and his new team, with a unique Commissioner for Energy and Climate and a Vice President for Energy Union will be able to create a unified European energy policy with a strong political commitment towards a low carbon energy roadmap. The challenge will be to deliver an improved balance between the three central goals of energy policy - security of supply, competitiveness and sustainability.

With the ongoing political crisis in Ukraine and Russia and the loss of competitiveness of the European industry as well as the slow economic recovery, both security of energy supply and competitiveness are now on a more equal level to sustainability on the political EU agenda than ever before.

The coming months will be very exciting as there are many important questions to be debated and decided on the energy and climate agenda. The major question is if there will be a political agreement on the 2030 climate and energy framework, when the heads of government meet in the Council in Brussels on 23-24 October. Most of the large Member States seem committed to concluding an agreement but the question lies with regards to Poland and some eastern European Member States when it comes to the proposed Greenhouse Gas (GHG) emissions reduction target of 40% by 2030.

Another key question is if there will be an EU-wide renewables target within the 2030 framework. The proposal on the table is an EU-wide target of 27%, but no national targets. Germany and France are in favour while the UK and Czech Republic are strongly opposed to a new renewable energy goal for 2030. My recommendation would be an overall technology neutral binding target for GHG emissions as I believe it is the most effective way of combatting climate change, keeping energy prices down and strengthening energy security. History has shown that a high amount of intermittent renewable sources without flexible affordable back-up power available can have a negative impact on both the grid stability and reduction of GHG emissions. In 2013 GHG emissions rose in Germany, Denmark and Portugal where coal-fired back-up capacity offset the impact of new wind and solar.

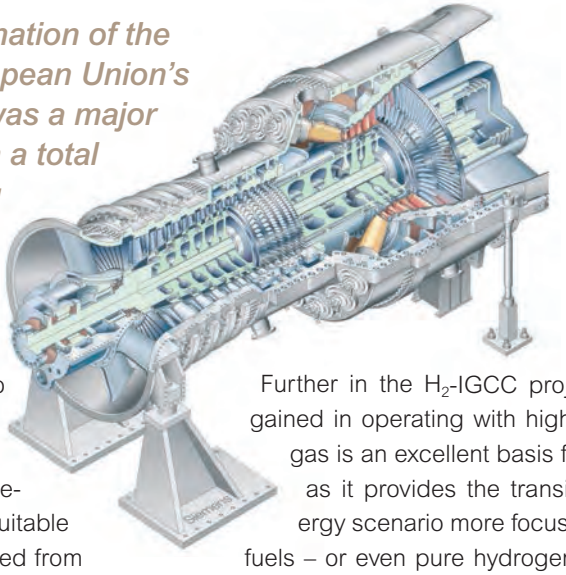
A third question is if we can expect a strengthened EU Emission Trading Scheme (ETS) from the ETS reform. The first proposal from the EC is the Market Stability Reserve (MSR), a mechanism which will remove and re-introduce allowances to the market in order to maintain a supply-demand balance. Further ETS measures to strengthen the price (Phase IV) will be expected if we get an agreement on the 2030 package.

Finally, I am pleased to announce that our programme for the IGTC-14 has now been finalised and can be downloaded on the ETN's conference website. With the uncertainties and opportunities of the future, this year's conference is not to be missed. I can promise you very interesting keynote sessions, interactive panel discussions, and technical presentations on promising R&D developments as well as extensive networking opportunities. I look forward to welcoming you to the Conference.

Results of the EU-funded project:

Low Emission Turbine Technology For Hydrogen-Rich Syngas (H_2-IGCC)

ETN has recently completed the coordination of the H_2-IGCC project, co-funded by the European Union's 7th Framework Programme for R&D. It was a major project, running from 2009 to 2014, with a total budget of 17.8 million euro (EU-funding 11.3 million euro) and with the participation of 24 partners from 10 countries.



The overall objective of the H_2-IGCC project was to provide and demonstrate technical solutions which would allow the use of state-of-the-art highly efficient, reliable gas turbines in the next generation of Integrated Gasification Combined Cycle (IGCC) plants, suitable for combusting undiluted hydrogen-rich syngas derived from a pre-combustion CO_2 capture process with a high flexibility.

The European electricity sector is undergoing a major transition to achieve an almost carbon-neutral electricity generation mix by 2050, with intermediate targets to be reached by 2020 and 2030. In order to fulfil the EU's long term goal of achieving an 80-95% reduction in GHG emissions, as stated in the EU Energy Roadmap 2050, the power sector will need to be 95-100% decarbonised. In order to meet these targets, implementation of carbon capture and storage (CCS) technologies is necessary. Based on the EU's long term targets, the objectives of the H_2-IGCC project were well aligned as integration of CO_2 capture technologies would have the highest impact on reducing the CO_2 emissions from gas turbines (GTs).

Results

However, due to the high amount of uncertainties in the European energy market, together with the extremely low-carbon price and the high cost of CCS, many demonstration initiatives have been and are being stalled. As a result large-scale deployment of this technology is only likely with new strong political commitments to intermediate and long-term emission reduction goals together with near-term incentives. Even though IGCC plants might not be economically competitive in the very near future, the H_2-IGCC project has advanced the 'technology-readiness' of all aspects when burning hydrogen-rich syngas in gas turbines, including the development of combustion processes, materials, turbomachinery and the optimisation of the whole plant. Several results of the project can also be used for spin-off applications, especially when it comes to the results of the more basic research in combustion, materials, turbomachinery, systems analysis and techno-economical evaluation.

Further in the H_2-IGCC project, the experience gained in operating with high hydrogen-rich syngas is an excellent basis from which to evolve, as it provides the transition towards an energy scenario more focused on hydrogen-rich fuels – or even pure hydrogen. This also goes in-line with the different pathways that are being discussed in the EU Energy Roadmap 2050 which are related to utilising excess renewable energy to produce hydrogen which could be stored or transported when or where it would be needed.

The project showed that utilisation of hydrogen-rich fuel resulted in a major impact on the compressor aerodynamics as well as the hot gas path and cooling system of the turbine. Although, within the compressor it was possible to maintain a reasonable high surge margin to allow for changes in cooling flow extractions and increased fuel flexibility, it was demonstrated that using clean syngas would only be possible with additional major compromises in the turbine design due to the significantly increased volume flow into the turbine.

Due to the use of a fuel gas produced from gasification of coal and its resulting impact on impurities in the hot gas entering the turbine, the consequences for turbine balding and coating were evaluated, tested and verified. The test rig used for materials and coating testing operated with a representative flue gas composition and temperature, thus providing the environment to reliably prove the concepts developed during the project. It was specifically designed and adjusted to meet the tight requirements of the project.

The project demonstrated cost-effective materials and coatings technologies able to overcome the component life-limiting problems of overheating and of hot corrosion and also validated materials performance data, life prediction and monitoring methods applicable to the industrial implementation in advanced IGCC plants.

Very intensive evaluation of the combustion process for undiluted, hydrogen rich, premixed type of combustor were per-

continued on page 3

Low Emission Turbine Technology For Hydrogen-Rich Syngas (H_2-IGCC)

continued from page 2

formed, including model development, numerical simulation as well as verification of the models and concepts in different levels of detail. Included were detailed and basic investigations on the combustion as well as more applied evaluations and tests targeting design issues of a full scale premixed type of gas turbine combustor. The results demonstrated that high hydrogen concentration (>50% vol.) in fuel gas mixtures do require significant changes to the fuel-air mixing/burner/combustor design of GT combustion systems. As such it indicates that using the same combustor for hydrogen-rich fuel and/or natural gas would most likely not be possible.

> ***"We had to learn the hard way – as others did before - that hydrogen as a fuel gas is quite a different "beast" compared to natural gas. Even though executing this project caused some sleepless nights, I definitely didn't want to miss the experience of working with this group of experts. Working together in such a big consortium of partners, the diversity of ideas being pursued was really impressive."***
>
> Peter Jansohn, Sub-Project Leader (Combustion), Paul Scherrer Institute (PSI)

Looking into the future

Additional research is still requested as Europe is currently facing new requirements and development challenges, which ask for high efficiency and low emissions even in load-following operation mode. This will put additional development demand on materials and coatings used for the hot gas path components in GTs, and their performance in service, as both place limitations on turbine performance/ reliability and represent significant elements in the capital and operating costs of the system.

Beyond the findings of the H_2-IGCC project, it is therefore still important to find solutions and demonstrate the applicability (at full scale/full pressure) of potential low emission, reliable (safe ignition, stable flames) combustion technologies. Issues to be addressed are safe combustion performance (flame stability, flashback, combustor cooling, thermoacoustics) and NO_x emission behavior for process conditions relevant to GTs integrated with pre-combustion carbon capture schemes and/ or solid fuel gasification (coal, biomass, process residues).

The complete results of the project can be found on the project website www.h2-igcc.eu ■

> ***"The coordinated efforts from 24 European partners, and the knowledge developed within this project is of high relevance and quality for future energy solutions for Europe. Using "real world" data for technical as well as economical evaluation of the studied power plant alternatives, rather than over optimistic theoretical values, provides the research community with data for future studies that can satisfy decision makers when it comes to selection of most competitive technological solutions for power generation."***
>
> Mohsen Assadi, Sub-Project Leader (System Analysis), University of Stavanger

Upcoming meetings and events

ETN Meeting/Event	Date	Location
High Level User Meeting and Dinner Debate (by invitation only)	13 October 2014	European Parliament Brussels, Belgium
International Gas Turbine Conference 2014	14-15 October 2014	Thon Hotel EU Brussels, Belgium
Exhaust Systems Meeting*	16 October 2014	Brussels, Belgium
Project Board and TC Chairs Meeting*	24-25 November 2014	Brussels, Belgium
ETN Board Meeting	4 December 2014	Brussels, Belgium
Gas Turbine Engineering CPD programme (organised by Cranfield University, in cooperation with ETN)	11-15 January 2015	Dubai, UAE
IAGT 2015 Symposium	19-21 October 2015	Banff, Canada
International Gas Turbine Congress (ETN members are entitled to a special discount)	15-20 November 2015	Tokyo, Japan

** Event open exclusively to ETN members*

Air Filtration Survey: *The Results are now available!*

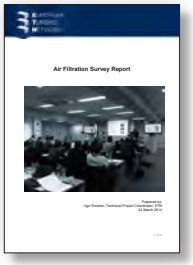
The results of the Air Filtration survey have been published and are now available on the ETN website.

On 20 February the European Turbine Network (ETN) together with AAF, Camfil and Donaldson organised an Air Filtration Workshop in Brussels. Prior the Air Filtration Workshop, a survey was distributed to capture the most important issues related to turbine filtration and engine operation.

During the Workshop, which took place on Thursday 20 February 2014 in Brussels, 36 participants joined to discuss the new developments on air filtration products and standards. The aim of the workshop was to offer a knowledge sharing opportunities to ETN members delivered through a series of presentations and roundtable discussions. Participants were given the opportunity to increase their awareness of air filtration science, standards and performance trends, to highlight their experiences and requirements in dedicated working groups (divided by offshore and onshore) and to complete a 38-question survey, co-developed by AAF, Camfil and Donaldson, related the most important issues associated to turbine filtration and engine operation.

Report

The report captured the most important issues related to turbine filtration and engine operation and collected cross industry specific data in order to better understand the priorities and experiences of turbine filtration from a user's perspective. The report covers, among others, filtration system design, international standards and data, filtration element performance and the relation of the aforementioned to turbine operation and the associated effect on the business in question. In total 22 completed questionnaires were received, where a contrast in areas of importance and a gap in the market satisfaction were noticed.

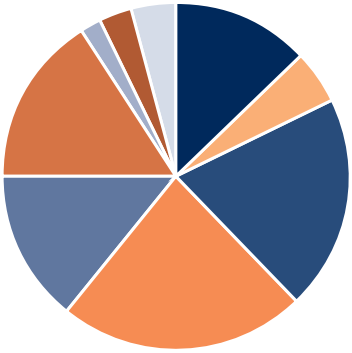


To view the report which outlines the direct results of the survey, please click here (please note that the report is available exclusively to ETN members upon login on the ETN website). ■

7th International Gas Turbine Conference

The European Turbine Network is delighted to invite you to the 7th International Gas Turbine Conference – The Future of Gas Turbine Technology (IGTC-14).

This is a biennial conference, which was attended in 2012 by over 160 delegates, from more than 80 different organisations in 20 different countries from North America, Europe, the Middle East and Asia.



Utility	13%
Oil & Gas	5%
OEM	20%
Supplier	23%
Consultancy / Maintenance	14%
R&D / Universities	16%
Policy-makers	2%
Press	3%
Others	4%

Keynote sessions

The keynote sessions will discuss the political, technical and market short and longer term outlook for the gas turbine industry, both in Europe and globally. Keynote speakers include high-level political representatives from the European Commission, the US Department of Energy, the International Energy Agency as well as high level industrial representatives. After the keynote sessions, parallel technical sessions discussing gas turbine technologies of tomorrow will take place.

Panel Discussions

The conference also includes interactive panel discussions with distinguished experts and high level policy makers which will address critical issues related to climate change mitigation in the context of the different and fast changing markets.

Technical sessions' topics:

- Innovative Low Carbon Cycles
- Optimising Combined Cycle Operations
- Materials and Lifetime
- Optimising Oil and Gas Operations
- Turbomachinery
- Combustion
- Flexible Operation and Fuel Flexibility
- Hydrogen-rich syngas operation

Confirmed speakers include:

- **Mechthild Wörsdörfer**, Director for Energy Policy, DG Energy, European Commission
- **Rodrigo Pinto Scholtbach**, Senior gas analyst, International Energy Agency
- **Beate Raabe**, Secretary General, Eurogas
- **Wim Broos**, Director Fleet Management, GDF SUEZ Energy Europe
- **Marcelo Accorsi** Miranda, Senior Consultant, Petrobras
- **Mansoor Al Najar**, Rotating Equipement Section Head, Gasco
- **Sergio Picon**, Vice President Power Market, EthosEnergy
- **Hongde Jiang**, Professor, Tsinghu University
- **Richard Dennis**, Turbine Technology Manager, US Department of Energy
- **Junior Isles**, Chief Editor, The Energy Industry Times
- High level representatives from all major OEMs

The IGTC-14 strives for optimal networking opportunities, by limiting the number of participants to 180 and through a small EXPOSITION to showcase some important service providers and suppliers in the gas turbine industry.

We look forward to welcoming you in Brussels at the IGTC-14!

Last chance to register!

Join us for an unparalleled networking experience. Deadline to register is 7 October 2014.

Feedback from the 7th International Gas Turbine Conference in 2012

"This meeting has been excellent as usual… and really interesting!"

Frederic ALPHONSE-FELIX, New Parts Engineering for High Tech Gas Turbines

"It was a great event. Good discussions, interesting people and perfectly organised."

Steve HEINEN, International Energy Agency

"Thank you once again for the opportunity to attend IGTC-2012. I thoroughly enjoyed the event's programme, which was well structured, as well as meeting a number of interesting industry experts – everyone was very friendly, which was great."

Heather JOHNSTONE, International Power & Environmental Group, PennWell Corporation

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New! **IGTC-14 App**

ETN is pleased to announce that this year's event will be complemented with a dedicated smart phone app! Get your **I-phone**, **smartphone** and **Android** ready – all you need to know about the event will be in your App: agenda, speakers, sponsors, partners, proceedings, maps and many more!

Each registered participants will receive a link to download the application shortly! ■

EU news summary

White Rose CCS Project to receive funding under the European NER300 funding

The European Commission announced that the UK based White Rose CCS Project will be awarded up to €300 million in funding as part of the second round of NER300 programme. Capture Power, the developer of the project, is a joint venture set up by Alstom, Drax and BOC to develop White Rose in close cooperation with National Grid, who will provide the CO_2 transportation and storage infrastructure. A final investment decision is expected towards the end of 2015 with a start-up in the 2018-2019 period.

Located on land adjacent to the existing Drax Power Station, near Selby in North Yorkshire, the 426MW new build power plant will burn coal with the potential to co-fire sustainable biomass and meet the equivalent power needs of over 630,000 homes. Fully equipped with CCS technology from the outset, 90% of all the CO_2 produced by the plant will be captured and transported by pipeline for permanent off-shore storage deep beneath the North Sea seabed. The White Rose CCS Project is planned to be the first large-scale oxyfuel project in the world with the ability to use biomass fuel for co-firing.

Dr. Graeme Sweeney, Chairman of Zero Emission Platform (ZEP), said: "This decision sends a strong and positive signal, reaffirming the importance of CCS deployment and that we must keep pushing European projects with the continued support both at EU and Member State level. ZEP's modelling shows that in the coming years CCS can create and secure an estimated total of 330,000 jobs across Europe. The EU's long-term goal of reducing GHG emissions by 80-95% by 2050 cannot be met cost-effectively without CCS. Achieving our emission reduction goals while maintaining Europe's industrial base is also essential for competitiveness, job retention and job creation in Europe."

Earlier in May, the International Energy Agency (IEA) published the 4th volume of its Energy Technology Perspectives report, which concludes that business-as-usual is not an option if Europe is to move to a "sustainable energy future" The report underlines that Carbon Capture and Storage (CCS) has a critical role to play in decarbonising the power sector and energy intensive industries as well as supporting energy efficiency. The IEA stated that the deployment of CCS is occurring too slowly due to high costs and a lack of political and financial commitment. Increased progress in CCS research, development and demonstration is needed to ensure cost-competitiveness and timely deployment. ■

EU news summary
continued

Energy Security high on the EU agenda

Europe emphasises on security of energy supply in the light of the crisis in Ukraine

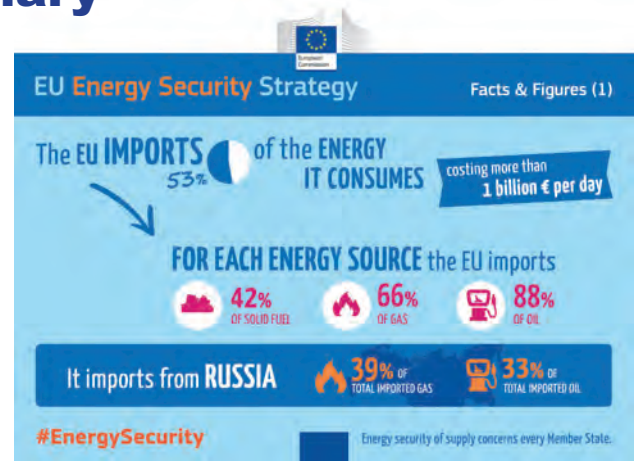
Today, the EU imports 53% of the energy it consumes and sources 24% of its gas from Russia, half of which passes through Ukraine. The International Energy Agency projects an increasing EU reliance on imported oil from around 80% today to more than 90% by 2035. Moreover, global rising demand for energy and insufficient competition in EU energy markets has sustained high commodity prices. In 2012, Europe's oil and gas import bill amounted to more than €400 billion representing some 3.1% of EU GDP compared to around €180 billion on average in the period 1990-2011.

To respond to this situation, the European Commission has released in May 2014 an **EU Energy Security Strategy** on how to reduce its energy dependence. Diversifying external energy supplies, upgrading energy infrastructure, completing the EU internal energy market and saving energy are among the main points of the strategy. The report also highlights the need to coordinate national energy policy decisions and the importance of speaking with one voice when negotiating with external partners.

On this proposed strategy, the European Energy Commissioner Günther Oettinger said: *"We want strong and stable partnerships with important suppliers, but must avoid falling victim to political and commercial blackmail. The EU and its Member States have a long list of homework in front of them: Collectively, we need to reinforce our solidarity with more vulnerable Member States. We also need to complete the internal energy market, improve our infrastructure, become more energy efficient and better exploit our own energy resources. Moreover, we need to accelerate the diversification of external energy suppliers, especially for gas. Only concrete actions will help."*

Short and medium term measures

In its report, the European Commission proposes to launch energy security stress tests as a short-term measure to ensure uninterrupted supplies in the future. These would be conducted on the regional or EU level by simulating a disruption of the gas supply. The aim is to verify how the energy system can cope with security of supply risks and to develop emergency plans and back-up mechanisms. The EU should, as proposed in the report, also engage with its international partners to develop new solidarity mechanisms for natural gas and the use of gas storage facilities.



© European Commission

In addition to the proposed short term measures, the strategy proposes actions in five key areas:

- Increasing energy efficiency and reaching the proposed 2030 energy and climate goals;
- Increasing energy production in the EU and diversifying supplier countries and routes;
- Completing the internal energy market and building missing infrastructure links to quickly respond to supply disruptions and re-direct energy across the EU to where it is needed;
- Speaking with one voice in external energy policy;
- Strengthening emergency and solidarity mechanisms and protecting critical infrastructure.

Further economic measures on Russia

On 11 September, the EU adopted a new package of restrictive measures targeting sectoral cooperation and exchanges with Russia to enter into force on 12 September. At a special meeting of the European Council on 30 August, EU leaders strongly condemned the presence and actions of Russian armed forces on the Ukrainian territory and called for preparatory work on further economic sanctions. Among the restrictive measures include:

- Restrictions on Russia's access to EU capital markets have been strengthened.
- EU nationals and companies may no more provide loans to five major Russian state-owned banks.
- Certain services necessary for deep water oil exploration and production, arctic oil exploration or production and shale oil projects in Russia may no more be supplied, for instance drilling, well testing or logging services.
- 24 persons will be added to the list of Russians with a travel ban and an asset freeze.

Next Steps

The EU Energy Security Strategy was discussed at the last EU Council meeting in June 2014 and will also be on top on the upcoming Council meeting, set to take place later in October. The heads of states are also expected to discuss security of supply as part of the 2030 climate and energy policy framework in October 2014. ■

EU news summary
continued

New leaders in Brussels

This autumn, a brand new team will be responsible for the future of Europe. Over the course of the summer, the President of the European Council, the European Parliament and the European Commission have been elected, and more recently, the new Commissioners have been selected by the New Commission President, Jean-Claude Juncker.

European Council

New President: Donald Tusk (Poland)

In August, the European Council elected Donald Tusk as its President for the period from 1 December 2014 to 31 May 2017. He was also appointed President of the Euro Summit for the same period. Donald Tusk will leave his current position as Prime Minster of Poland and replace Herman Van Rompuy (Belgium).

European Parliament

New President: Martin Schulz (Germany)

In July 2014, the Members of the European Parliament re-elected Martin Schulz as President of the European Parliament for another two and a half year term until January 2017. Mr Schulz is the first President in the history of the European Parliament to be re-elected for a second term.

European Commission

New President: Jean-Claude Juncker (Luxembourg)

In July, Jean-Claude Juncker has been elected President of the European Commission by a strong majority in the European Parliament plenary session. It was the first time that the European Parliament elected the Commission's President, in the new process following the entering into force of the Lisbon Treaty. Mr Juncker will replace Mr José Manuel Durão Barroso (Portugal).

New Commissioners dealing with energy and climate

On 10 September, Jean-Claude Juncker announced his team of Commissioners, which included many structural changes, introducing a First Vice-President (**Frans Timmermans**, The Netherlands) as well as six additional Vice-Presidents. The new European Commission will focus on tackling the main political challenges Europe is currently facing, including employment, triggering more investment, stabilising the economy, creating a connected digital market as well as a credible foreign policy and ensuring energy security for Europe.

Alenka Bratušek from Slovenia (former Slovenian Prime Minister) will be the Vice President of the Energy Union, **Miguel Arias Cañete** from Spain (former Minister of Agriculture, Food and Environment) has been appointed as the Climate Action and Energy Commissioner and **Karmenu Vella** from Malta will be the new Environment, Maritime Affairs & Fisheries Commissioner. **Federica Magnerini** (Italy) has also been appointed as the High Representative that will deal with the external dimension of energy.

Next Steps

Now that Jean-Claude Juncker allocated a portfolio to each Commissioner appointed by Member States, the proposed Commissioners will make an individual presentation to the European Parliament from 29 September to 3 October, known as the hearings of commissioners. The final vote on the College of Commissioners will take place in the plenary session at the European Parliament on 21 October. ■

EU-funded projects

In September 2014, the European Turbine Network has submitted two proposals under Horizon 2020, the EU funding programme for Research and Innovation.

The **FlexGen Project** proposal has been submitted on 3 September under the call *LCE17 Highly flexible and efficient fossil fuel power plants*. The overall objective of this project is the development of a simulation and decision support tool to enable flexible efficient fossil fuelled power plant operation in an environment of increasing share of intermittent renewable power. It aims at optimising plant operation by establishing an advanced understanding of the complex relationship between plant efficiency, plant flexibility, emissions, component life, economic viability and security of supply. The FlexGen consortium includes 13 partners coming from a variety of working fields and from 10 countries across Europe, including ETN as a project coordinator.

The **SOLFLEX Project** proposal has been submitted on 10 September under the call *LCE3 Demonstration of renewable electricity and heating/cooling technologies*. The key challenge of this project is to develop and demonstrate an industrial-scale hybrid solar gas turbine, with high solar receiver temperatures, as well as high combustor and turbine inlet temperatures in order to harness solar energy with a maximum of efficiency and allow the full flexibility of this technology to be used. The SOLFLEX consortium has 21 partners from the entire gas-turbine and solar power value chain including manufacturers, operators and R&D institutes coming from 8 countries across Europe, including ETN as a project coordinator. ■

New ETN members

- Sesta Lab (Italy)
- Institut Carnot (France)

SESTA LAB Setup Your Combustion

INSTITUT CARNOT ESP

ETN Team

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Managing Director

Dominique Cornut
Policy and Communications Manager

Audrey Krzemien
Event Management and Communication Officer

Romy Flower
Financial and Administrative Officer

Ugo Simeoni
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