



**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.**



**Christer Björkqvist**  
Managing Director

*The gas turbine industry is currently going through a restructuring accumulative consolidation with mergers, strategic alliances and joint ventures comparable with the car industry 10 years ago. The latest developments among the giants include GE's upcoming acquisition of Alstom Power; Siemens' takeover of Rolls-Royce Energy aero-derivative gas turbine and compressor business; the joint venture between Wood Group GTS and TurboCare; the merger of Mitsubishi Heavy Industries with Hitachi and their takeover of Pratt and Whitney's Power Systems. We then have Ansaldo Energia who recently entered a joint venture with Shanghai Electric and signed an alliance with Doosan Heavy Industries.*

*In Europe, OEMs, suppliers and service companies have been facing a slowdown and the major OEMs are now using this opportunity to positioning themselves in order to ensure a competitive edge in an intensifying global competition for future promising markets. The recent consolidations also show an increased interest in aero-derivative simple-cycle gas turbines as the major OEMs try to strengthen their positions in the growing oil and gas market as well as in the field of decentralised power generation, where operational flexibility, lower capital investment cost and smaller footprint are attractive elements.*

*While the OEMs are facing a bright future, the future of the European utilities is more uncertain as they suffer from the lack of an efficient, stable and well-functioning European-wide energy policy. The expansion of renewable generation and low coal price is causing a vast reduction of operating hours and even the mothballing of state-of-the-art combined cycle plants. To overcome this challenge, utilities are now massively cutting capital spending in maintenance and research as well as selling assets, where there is a buyer.*

*The oil and gas industry on the other hand is booming as there is plenty of gas available due to amazing discoveries and high demand. Even so, their return on capital is decreasing as the exploration and operational cost to develop these resources have increased dramatically over the last years due to the increased risk and complexity.*

*As the market's demand is becoming more and more diversified, the gas turbine's R&D topics have become slightly wider and more complex.*

*The complex interaction between economical, technical and environmental issues becomes crucial in the operational decision making process for gas turbine users active in the European market. However, it is questionable whether the utility managers would really like to know the true cost of cycling when opportunities for short-term profits are in sight in the European market.*

*Looking into the future I believe our industry is on one hand facing a bright future with many opportunities but on the other hand faces an increased complexity and uncertainty which will require new business models that rely on risk sharing, increased networking and cooperation to a much higher extent than in the past. ETN, with its active committees and experts across the whole value chain, provide this powerful platform to guide and enforce technical gas turbine development with the aim to reduce operational cost and risk and increase gas turbine reliability and availability. All of the above topics will also be addressed and debated in ETN's upcoming International Gas Turbine Conference "The Future of Gas Turbine Technology" which I hope you will attend.*

## In this issue

Gas Turbine Anniversaries, 75 Years Ago ...	2
ETN's Technical Committees: New Developments	3
New ETN Project Board Member	3
7 <sup>th</sup> International Gas Turbine Conference	4
Past and upcoming meetings and events	4
ETN's Educational Programme	6
New Project Section on the ETN Website	6

# Gas Turbine Anniversaries, 75 Years Ago ...

*Gas turbines have gained a salient position for electric power generation on a global scale – either as simple cycle installations or to a rapidly increasing extent as part of combined cycle power plants. This development is the result of many inherent advantages of this technique in comparison to alternatives – not the least its superiority in the category of cost of electricity.*

In the history of energy conversion, the gas turbine is relatively new: The first utility gas turbine to generate electricity at Neuchâtel, Switzerland ran at full power at Baden, 75 years ago and was designed and constructed by BBC Brown Boveri & Cie. The acceptance tests were commissioned to the nestor in the field of thermal machines, the then 80 year old Professor Aurel Stodola, ETH Zurich. The almost ceremonial spirit of these tests is captured in Figure 1.



Figure 1 First power generation gas turbine certification at BBC Baden, Switzerland on 7 July 1939; A. Stodola, 80 – with senior engineer's frock coat and bowler hat at centre © Alstom

The decisive full load test of 4 MW generator power was carried out between 10:10 and 11:10 on Friday 7 July 1939 with the following measured data at guarantee conditions of 20°C inlet temperature and 3,000 rpm speed:

▪ thermal efficiency	17.38 %
▪ mass flow	62.2 kg/s
▪ compression ratio	4.39
▪ compressor efficiency ad.	84.9 %
▪ turbine efficiency ad.	88.4 %

Till then the gas turbine had looked back on a long and frustrating development history. In comparison, the steam piston engine or turbine was relatively easy to design and manufacture. Little effort is required to force water in a boiler, to heat it and when steam is formed at high pressure and led to either an expansion piston or turbine, it will produce more power than required by the feed pump. The same applies for internal combustion/piston engines. Since in comparison, gas turbines could not use the high process temperatures of inter-

nal combustion/piston engines, the demand for a positive work output immediately requested low losses, especially on the compressor side. For decades many inventors produced machines that either never ran self-driven at all or the output was so small, that the overall effort was not justified in view of other competitive concepts. To this category belong the Norwegian Aegidius Elling, who realised the first constant-pressure gas turbine to produce a net output of 11 hp (in the form of compressed air) in 1903, - Franz Stolze of Berlin, who tested an all-axial gas turbine concept already in 1904 and the French René Armengaud and Charles Lemâle at Paris in 1905-1906. Their experimental gas turbine with 25-stage radial compressor from BBC and a water-cooled 2-stage Curtis wheel achieved self-sustained operation with 6-10 kW output power by adding large quantities of steam, generated in combustor cooling and by feeding it back to the turbine.

The foregoing first time, successful demonstration of an effective axial

*continued on page 3*



Figure 2 Neuchâtel gas turbine 1939/40, relocated to Birr, Switzerland 2007

## Gas Turbine Anniversaries, 75 Years Ago ...

continued from page 2

compressor by Claude Seippel, BBC was key to the gas turbine breakthrough in 1939. Beginning already in the late 1920s, BBC had started to transfer Prandtl's aerodynamic concept of lift/drag optimised airfoils to turbomachinery, implementing it in the successful product development of all-axial turbo-sets for constant-pressure Velox boilers, equipment for oil cracking processes according to the Houdry principle and numerous stand-alone axial compressor projects.

Interestingly, the first gas turbine flight also took place in 1939 – only 51 days

after the first full-power test at Baden: A Heinkel He 178 aircraft, jet-powered by Hans von Ohain's HeS3B with radial turbomachinery took off on 27 August from Rostock-Marienehe, Germany.

Consequently, 2014 will see numerous anniversary references to these historic events. After 62 years in service as a stand-by unit, the first power generation gas turbine has been preserved and is now on exhibition as an ASME Technical Land-mark in a publicly accessible pavilion on Alstom's premises at Birr, Switzerland (*Figure 2, see page 2*). ■



Just in time for this anniversary a technical - historic account appeared by the author Dietrich ECKARDT.

His 500 p. book "**Gas Turbine Powerhouse**", DeGruyter, 2<sup>nd</sup> ed., € 60 [www.degruyter.com/view/product/430753](http://www.degruyter.com/view/product/430753) tells the story of the power generation gas turbine from the perspective of one of the leading companies in the field over a period of more than 100 years – written by an engineer.

## New ETN Project Board Member

ETN is happy to announce that Dominique Orhon from Total is a new member of the ETN Project Board. Mr Orhon specialises in the following fields:



- Turbomachinery design, integration in process, operation and trouble shooting (including gas turbine);
- Recommendation for new gas turbine to be implemented in Total's fleet;
- Oil and gas plant design, construction, commissioning and operation.

To view the full list of ETN Project Board members, please [click here](#).

## ETN's Technical Committees: New Developments

*At the 2013 October Workshop in London, UK, the Project Board recommended to have two chairpersons for each Technical Committees (TC), respectively one representative from the industry and one/two representatives from the R&D community.*

The TCs will meet annually to discuss technology development in defined priority fields and explore new research and development initiatives in line with the users' requirements. The technical committees cover all areas of future gas turbine technology development and serve as forums where ETN members meet to discuss technical issues and development requirements as well as to exchange knowledge and experience.

Please find below the list of the newly selected chairpersons per Technical Committee:

### TC1: Low Carbon Gas Turbine Operation

**Chair:** Mohsen Assadi, University of Stavanger

**Co-chair:** Chris Lappee, Vattenfall

### TC2: Operational and Fuel Flexibility

**Chair:** Jean-Louis Vignolo, GE Power & Water

**Co-chair:** Yannis Hardalupas, Imperial College London

### TC3: Material Degradation, Repair Technologies and Manufacturing

**Chair:** Ron van Gestel, Chromalloy

**Co-chairs:** Daniel Mack, Jülich Research Center and Nigel Simms, University of Cranfield

### TC4: Condition Monitoring and Instrumentation

**Chair:** Chris Dagnall, GL Noble Denton

**Co-chair:** Herwart Hönen, RWTH Aachen University

### TC5: Asset Management

**Chair:** Pascal Decoussemaeker, Alstom

**Co-chairs:** Christoforos Romesis, NTUA and Giuseppina Di Lorenzo, University of Cranfield

For more information on the TCs' vision and the research areas, please [click here](#). ■

## 7<sup>th</sup> International Gas Turbine Conference

*The European Turbine Network is pleased to invite you to this year's International Gas Turbine Conference – The Future of Gas Turbine Technology (IGTC-14). This is a biennial conference, which welcomed in 2012 more than 175 senior gas turbine professionals from 27 different countries, from Europe, North and South America, the Middle East and Asia, and will be held on 14-15 October 2014 in Brussels, Belgium.*

IGTC-14 will have four keynote and panel sessions discussing the political, market and technical short and longer term outlooks for the gas turbine industry. Keynote speakers will include high-level political representatives from the European Commission, the US Department of Energy, the International Energy Agency and high-level industry representatives. Once the keynote sessions have outlined the policy and commercial expectations of the future, there will be parallel technical sessions discussing gas turbine technologies of tomorrow.



### **Topics of the technical sessions include:**

- Innovative Low Carbon Cycles
- Optimising Combined Cycle Operations
- Materials and Lifetime
- Optimising Oil and Gas Operations
- Turbomachinery
- Combustion
- Flexible Operation and Fuel Flexibility
- H<sub>2</sub>-IGCC

The Conference strives for unparalleled networking opportunities, by limiting the number of participants to 180, and through a small exposition to showcase some important suppliers in the gas turbine industry.

### **Programme:**

To view the preliminary programme, please [click here](#).

### **Registration:**

[Register now](#), places are limited!

### **Sponsorship opportunities:**

There are still some [sponsorship opportunities](#) available for the IGTC-14. Please contact the [ETN office](#) should you be interested in promoting your organisation at the Conference.

We look forward to welcoming you at the 7<sup>th</sup> International Gas Turbine Conference! ■

## Upcoming meetings and events

ETN Meeting/Event	Date	Location
ETN Board Meeting*	9 July 2014	ETN office Brussels, Belgium
High Level User Meeting and Dinner Debate*	13 October 2014	European Parliament Brussels, Belgium
International Gas Turbine Conference 2014	14-15 October 2014	Thon Hotel EU Brussels, Belgium
Gas Turbine Engineering CPD programme (organised by Cranfield University, in cooperation with ETN)	11-15 January 2015	Dubai, UAE

\* Event open exclusively to ETN members

# THE FUTURE OF GAS TURBINE TECHNOLOGY

7<sup>th</sup> International Gas Turbine Conference  
14-15 October 2014 | Brussels | Belgium

**The International Gas Turbine Conference (IGTC-14)**, organised biennially by ETN, aims at raising awareness of gas turbine (GT) technology development needs and at providing the opportunity to meet and exchange ideas with industry leaders, policy makers and technical experts from the whole value chain attending from Europe, North America, the Middle East and Asia.

## 5 key reasons to attend the IGTC-14:

- To gain insight on the current global & regional market opportunities;
- To get an overview on technical requirements from oil & gas operators and utilities based on operational experience;
- To discuss the role of GTs in the context of future energy policy scenarios;
- To be informed on the state-of-the-art and ongoing GT research and developments;
- To meet and connect with the entire value chain of the GT community.

**Register now, places are limited!**



[www.etn-gasturbine.eu](http://www.etn-gasturbine.eu)



The European Turbine Network is a unique membership association bringing together the entire value chain of the gas turbine technology community in Europe. Through cooperative efforts and by initiating projects, ETN optimises gas turbine research and technology development and promotes environmentally sound gas turbine technology with reliable and low cost operation.

## ETN's Educational Programme



As part of ETN's new educational programme, a series of gas turbine short courses are being planned. The upcoming course will take place on **11-15 January 2015** in **Dubai, UAE**, organised by Cranfield University, in cooperation with ETN.

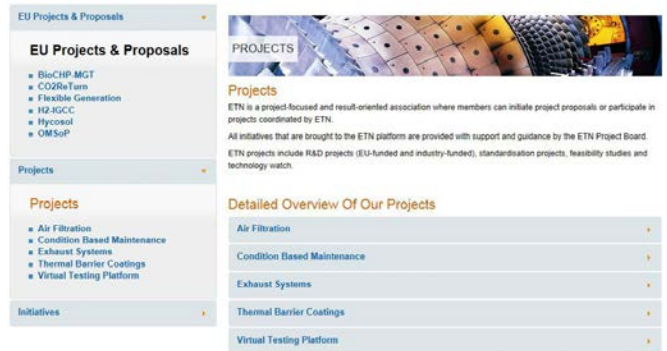
There are three courses available:

- Introduction to Gas Turbines and Performance
- Aspects of Gas Turbine Technology
- Gas Turbine Technology for Operations and Maintenance Engineers

The courses are dedicated to operators located in the Middle East and Asia. The content has been chosen primarily to be of benefit to employees who are (or will be) involved in engine performance evaluation, operations and maintenance.

ETN members are entitled to a 10% discount on the courses fee. For more information on the structure and content of each course, please visit the website by [clicking here](#). ■

## New Project Section on the ETN Website



The project section of ETN's website has been restructured in order to increase the visibility and provide visitors with a more comprehensive list and understanding of on-going initiatives and projects. The aim is to make ETN's projects, documents and material easily identifiable and the project section easier to navigate for visitors who wish learn more on ETN projects.

The project section now contains a description of the projects available to the wider gas turbine community, including a project outline, the list of current partners and the latest developments on the project. Additionally, a new section named "Documentation" is now available exclusively to ETN members and includes documents such as agendas and minutes of meetings, presentations, survey results, documents of reference and more.

To visit the new Project section of ETN's website, please [click here](#). ■

## ETN Team



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