Ultra Low NOx Gas Turbine Combustion
Monday 16 – Friday 20 January 2017

Please pass this leaflet to a colleague if this course is not relevant to you

Image courtesy of Siemens
Gas turbines are a major source of new electricity generating plans, but they have to meet severe NOx and CO emissions legislation in many countries. This course will address the technology options for industrial gas turbines necessary to meet 25ppm NOx regulations on liquid fuels and for <10ppm on natural gas (with 30ppm CO). The design options for low NOx combustors for liquid fuels for aero engine applications will also be discussed. The demand for <5ppm NOx in some countries has led to the course reviewing design features for low single digit NOx combustion. Combustion operating conditions for 1-3ppm NOx are overviewed as well as industrial gas turbine combustor redesign for 3ppm NOx compliance.

For aero-gas turbines NOx reduction is becoming more important and future designs are following the design procedures of lean low NOx combustion from the industrial sector. However, the inlet temperature to the combustor is about 1000K with pressures of 60 bar at take-off and this creates severe problems for NOx control. As only liquid fuels are viable for aero gas turbines the problem of fuel atomisation and auto ignition in premix ducts will be discussed.

The principles of low NOx designs are the same for all the applications of gas turbines and this course draws on information from the various gas turbine fields of aero, industrial and automotive as the cross fertilisation of ideas between the various areas is an important part of low NOx technology development. Each application area has its own specific problems which will be discussed on the course.

A common problem with low NOx gas turbines is that of acoustic problems which will be discussed in the course. The principles of low NOx designs are the same for all the applications of gas turbines and this course draws on information from the various gas turbine fields of aero, industrial and automotive as the cross fertilisation of ideas between the various areas is an important part of low NOx technology development. Each application area has its own specific problems which will be discussed on the course.

Course director
Professor Gordon Andrews, Energy Research Institute (ERI), School of Chemical and Process Engineering, University of Leeds

This annual short course is updated for each delivery with the latest publications on low NOx gas turbines.

Intended audience:
- Combustion designers in gas turbine manufacturers
- Operators of modern, low NOx electrical generation systems, including combined cycles
- Environmental legislators

Course Accreditation
This course is in association with the Institution of Diesel and Gas Turbine Engineers, which is devoted to the advancement of Diesel and Gas Engines, Gas Turbines and related products and technology. The course has also been approved by the Institution of Gas Engineers & Managers for Continuing Professional Development (CPD) purposes.

The Energy Institute has approved Leeds University Faculty of Engineering as an Approved Training Provider

Other related courses:
- Energy from Biomass Combustion
  Monday 9 - Wednesday 11 January 2017
- Industrial Air Pollution Monitoring
  Monday 27 February - Wednesday 1 March 2017
- NOx and Particulate Real Drive Emissions
  Monday 15 - Friday 19 May 2017
- Engine Emissions Measurement
  Monday 19 - Friday 08 June 2017

Image courtesy of Siemens
Further information

**Venue**
The venue for the course will be Weetwood Hall Conference Centre and Hotel which offers first-class hotel facilities, a business centre and ample parking facilities.

Weetwood Hall Hotel is ideally situated 15 minutes north of the centre of Leeds in wooded grounds at the junction of the Otley Road and the outer ring road. It is just 15 minutes from Leeds Bradford International Airport and a short distance from the A1, M1, M606, M621 and M62 motorways. Further details can be found at [www.weetwood.co.uk](http://www.weetwood.co.uk)

**Course fees**
The following course fees include the cost of tuition, course materials, lunches and light refreshments for the days of attendance:

- Full five days: £1750
- Any one day: £440

**Accommodation**
Bed and breakfast accommodation is available at the course venue, Weetwood Hall Conference Centre and Hotel.

We have negotiated the following special rates per night:
- Friday – Sunday evening, bed and breakfast: £78
- Monday – Thursday evening, bed and breakfast: £82

To take advantage of the special rates we have negotiated with the hotel for our course delegates, please book using the instructions below:

1. Log onto: [http://www.engineering.leeds.ac.uk/short-courses](http://www.engineering.leeds.ac.uk/short-courses)
2. Select ‘Course title’
3. Select the ‘Accommodation’ tab in the drop down menu and click ‘Book your hotel accommodation’
4. Complete the following fields: Arrival Date, Departure Date, Rooms, Adults, Children.
5. Click the ‘Check Availability’ button (N.B. you will not need to click ‘Book your hotel accommodation’)
6. Proceed with your booking as instructed by the booking system.

A list of alternative hotels is available on request.

Delegates are responsible for their own evening meals except on Monday – Thursday evening, bed and breakfast.

The following course fees include the cost of tuition, course materials, lunches and light refreshments for the days of attendance:

- Full five days: £82
- Any one day: £175

**How to book**
Booking for this course should be completed through our secure Online Store. To complete your booking please follow the instructions below:

1. Log on to our Online Store at: [https://store.leeds.ac.uk/](https://store.leeds.ac.uk/)
2. Select Conferences and Events in the left-hand navigation bar.
3. Select CPD Faculty of Engineering.
4. Select the course or event for which you wish to register and click on ‘Book’.
5. If you are a new user, please follow the instructions to register. If you already have an account log in as instructed.
6. Complete the application process as directed by the booking system.

You will receive an automatic confirmation email within 24 hours of your booking.

**Course dinner**
The course dinner will be held at a Leeds city centre restaurant and is included in the course fee. This will take place on Thursday evening and transport from and to Weetwood Hall Hotel is provided. The dress code is smart casual. If you would like to attend please indicate when booking.

**Accessibility**
Please let us know if you have any specific requirements including any access or dietary requirements in relation to this course.

**For online booking queries and for all other enquiries please contact:**

Jenny Carter
CPD, Conference & Events Coordinator
CPD, Conference & Events Unit
Faculty of Engineering,
School of Civil Engineering G.04
University of Leeds
LEEDS, LS2 9JT, UK.

**Contact details**

- T: +44 (0) 113 343 8104
- E: cpd@engineering.leeds.ac.uk
- W: [www.engineering.leeds.ac.uk/short-courses](http://www.engineering.leeds.ac.uk/short-courses)
- @LeedsUniCPD

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Terms and conditions for booking

**Payment**
In full should accompany your booking. The course fee is exempt from VAT. Fees must be paid in full no later than 15 working days before the course commences. Failure to pay may result in attendance being refused.

**Registration**
Registrations are accepted on the understanding that the printed programme is given in good faith but may have to be re-scheduled or the speakers changed for reasons outside our control. The University of Leeds reserves the right to cancel or postpone the course, in which case fees will be refunded in full. In the event of cancellation, the University will not be held liable for delegates travel or accommodation expenses.

**Delegates**
In the event of cancellation, the University will not be held liable for delegates travel or accommodation expenses.

**Cancellation**
If you are unable to complete your registration using the online booking system please contact the CPD, Conference & Events Unit to discuss alternative arrangements.