

<b>Title:</b>	HVDC connected offshore wind power plant modelling and control
<b>Organizer:</b>	Senior Researcher, Nicolaos A. Cutululis, <a href="mailto:niac@dtu.dk">niac@dtu.dk</a> Researcher, Ömer Göksu, DTU Wind Energy, <a href="mailto:omeg@dtu.dk">omeg@dtu.dk</a>
<b>ECTS:</b>	5
<b>Schedule:</b>	The course is not following DTU's normal schedule. 19 weeks, 01/03/2018–30/06/2018
<b>Evaluation:</b>	Written report, pass / not pass, internal examiner
<b>Examiner:</b>	Professor, Poul Sørensen, <a href="mailto:posq@dtu.dk">posq@dtu.dk</a>
<b>Place:</b>	DTU Wind Energy

**Scope and form:** Introductory lecture / self-study under supervision / discussions with supervisors

**Description:** The purpose of the course is to obtain knowledge about the start-up, operation, control, stability analysis, and ancillary service provision of HVDC connected offshore wind power plants.

**General course objectives:** This course will give the student a detailed understanding of how to operate and select the control paradigm of the converters (AC-DC substations and wind turbines) in order to have a stable HVDC grid which is able to satisfy the grid code requirements that are determined by different TSOs. The steady-state power flow and dynamic behaviors in transient conditions are expected to be simulated in the Matlab/SIMULINK platform.

**Learning objectives:**

The learning objectives of this course are:

- Understand how to include the aggregated model of wind turbines in AC side of an offshore DC grid
- Understand the operation schedule of HVDC offshore grid

- Learn how to simulate HVDC grids in Matlab/SIMULINK (DigSILENT)
- Understand how to control power flow for HVDC connected offshore wind power plants
- Analyse voltage and angle stability in an offshore DC grid

**Course literature:**

[1] Working Group B4.55, "HVDC Connection of Offshore Wind Power Plants," CIGRE, Tech. Rep. 619, May 2015

[2] ENTSO-E network code on requirements for grid connection of high voltage direct current systems and direct current-connected power park modules

<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1447&from=EN>, 26 August 2016

[3] Zeni, L, Hesselbæk, B, Sørensen, PE, Hansen, AD & Kjær, PC 2015, Control of VSC-HVDC in offshore AC islands with wind power plants: Comparison of two alternatives. in Proceedings of 2015 IEEE PowerTech. IEEE

[4] Cigre, TB 604 2014 Guide for the Development of Models for HVDC Converters in a HVDC Grid