Module name	Low Carbon Power Technology
Module code and mode of delivery	Code: MEP55B24 Delivery: Blended Learning through Blackboard VLE/LMS, face-to-face teaching and presentations seminars.
Module ECTS Weighting	5ECTS
Semester of delivery	S1
Module Contact Hours	33 hours lectures (hybrid synchronous online and face-to-face), approx. 50 hours independent student learning, 11 hours tutorials and seminars (face-to-face), approx. 30 hours continuous assessment in the form of technical presentation, class test and student assignment to design and model an energy power plants.
Module Coordinator	Prof Stephen Spence
Module teaching staff and academic titles	Prof Stephen Spence
Module description—content	Development and implementation of sustainable electricity generation is a principal requirement for modern society. This requires reliable energy supply with minimal toxic or greenhouse gas emissions. Achieving this requires diversification of energy sources, more efficient energy conversion and large-scale energy storage to smooth daily variations in generation and demand. This course will establish the foundational physical principles that enable the extraction of useful work / energy from various sources (thermal, fluid, chemical, nuclear and hydro), and present the current state of the art in power generation machinery. The important methods of power generation will each be examined, with foundational analysis, in the context of reducing greenhouse gas emissions. Students will learn to analyse energy cycles for the important configurations of steam plants and gas turbines, including analysis of component performance including pumps, compressors, turbines, heat exchangers and combustors. The students will learn about and analyse advanced natural gas turbine power plants including combined cycle, cogeneration plants, hybrid GT Fuel cell plants and combined heat and power. Nuclear energy production will be presented, covering the history of nuclear, underlying physics, basic components,

	reactor types, neutron moderation, heat transfer and coolant system. The main types of hydraulic turbines and pumps will be presented and analysed in the context of hydroelectric power generation and pumped hydro storage. Other methods of large-scale energy storage will be presented, including thermal storage, compressed air and gas, batteries and electrolysis. Students will learn the importance of effective storage as part of decarbonising energy and will analyse these systems to determine the overall round-trip efficiency of energy storage to judge their viability. Students will learn to evaluate the different power generation technologies in the context of carbon emissions, efficiency, cost, flexibility and the impacts of integrating renewable sources along with thermal power plant. [Other important energy technologies, including wind, solar, tidal, fuel cells, smart grids, and distributed power, are addressed in other modules]
Module learning aims/objectives	The key objectives are as follows: • To give students sufficient fundamental understanding of a wide range of low carbon power generation technologies to enable them to undertake energy and carbon analysis of such systems. • To enable students to critically judge the feasibility and sustainability of power generation systems considering carbon emissions, fuel sources, energy efficiency, flexibility and cost. • To allow students to develop and use their own basic. computational models to analyse and compare energy systems. • To enable students to judge the technical, physical, economic impacts of energy systems and present clear arguments with supporting data for choosing appropriate energy systems.
Module learning outcomes	On successful completion of this module, students should be able to: MLO1.1. Articulate the importance of efficient low carbon energy systems for the sustainability of modern society MLO1.2. Evaluate and compare the efficiency, sustainability and carbon impact of various power generation systems

	MLO1.3. Use fundamental engineering science to analyse and predict the performance of various low carbon energy technologies MLO1.4. Develop a basic computational model and use it to analyse a power generation system MLO1.5. Demonstrate an understanding of the balance between commercial and environmental sustainability and the time scales of investments and benefits MLO1.6. Quantitatively assess the potential for various renewable energy technologies to complement or replace conventional power generation systems
Module assessment, separate components and their weighting to be mapped into SITS	This module is assessed through 100 % Continuous Assessment (A single SITS component). There will be three assignments during the semester: 1. A technology review presentation to the class, with Q&A, as part of the module seminar series (50%). 2. An analytical model of a gas turbine / steam cycle generating system (35%). 4. A class test on nuclear power technology (15%). Assignment timings and marks weightings will be published during the module. Any changes to the proposed assignment list above will be discussed with the class during the module.