Course unit title:	Sustainable Energy I				
Course unit code:	AEEE361				
Type of course unit:	Required				
Level of course unit:	Bachelor (1st Cycle)				
Year of study:	3				
Semester when the unit is delivered:	5 (Fall)				
Number of ECTS credits allocated:	6	Lectures:	3	Labs:	0
Name of lecturer(s):	Dr Nicholas Christofides				
Aim of the Course	The course highlights the importance and necessity for sustainable energy taking into consideration the modern way of living, energy requirements, future energy forecasts, future trends and the need for energy saving. The aim is to also stimulate students and acquaint them with the various elements that constitute the road towards a sustainable energy future. All the above is in conjunction and related to the targets for lower carbon emissions and renewable energy penetration.				
Learning outcomes of the course unit:	• Differentiate between conventional and distributed electrical energy generation • Concept of smart and micro-grids and their relation to sustainable energy • Recognize the necessity for low carbon sectors and identify low carbon technologies • Understand the importance of energy storage and identify energy storage technologies • Appreciate the role of electric vehicles for sustainable energy • Familiarization with multi-generation methods and their relation to sustainable energy				
Mode of delivery:	Face-to-face				
Prerequisites:		Co-requisites:	AEEE360		
Course contents:	1. Conventional versus dispersed (distributed) generation: advantages and disadvantages, multi-generation (cogeneration, micro CHP, waste heat recovery, tri-generation, heat storage, heat networks), steady- state operation of distributed generation systems, full-system energy flows to/from supply and to/from loads, selection of technologies and configurations, system reliability and condition monitoring. 2. Smart grids and micro-grids: introduction, transmission and distribution perspectives, design, voltage and frequency control, distributed generation and active network management, present and future challenges 3. Low carbon emissions and technologies: introduction, climate mitigation and adaptation, bio-renewables (bio-energy, bio-chemicals, bio-materials), production and conversion of biomass 4. Energy storage technologies: introduction, battery principles-design and operation, hydrogen transmission and storage infrastructure, solar thermal storage, pumped-hydro storage, energy storage for cooling, energy storage in organic fuels 5. Electric Vehicles: introduction and definitions, plug-in concept and relation to smart grids, electric vehicles with fuel cells, electric vehicles with batteries (lead acid based, nickel based, sodium based, lithium based, metal-air based), hybrid vehicles, power management techniques of electric vehicles, efficiency of electric vehicles				
Recommended and/or required reading:					
Textbooks:	• James Momoh, *Smart Grid: Fundamentals of Design and Analysis*, Wiley-IEEE Press, 1st edition, 2012 • F.S. Barnes, J.G. Levine, Large Energy Storage Systems Handbook, CRC Press, 2011				

	• P. Mancarella (editor), G. Chicco (editor), Distributed Multi-Generation Systems: Energy Models and Analyses, Nova Science Pub Inc, 2008
References:	• J. Newman, K.E.Thomas-Alyea, Electrochemical Systems, 3rd Edition, Wiley, New York, 2004 • A.J.Bard and L.R.Faulkner, Electrochemical methods: fundamentals and applications, 2nd Edition, Wiley, New York, 2001 • F.C.Walsh, A First Course in Electrochemical Engineering, 1993 • C A. Almansoori, and N. Shah, Design and Operation of a Future Hydrogen Supply Chain – Snapshot Model, Chemical Engineering Research and Design, 84(A6), 2006, page 423-438 • A. Sims (ed) Bioenergy options for a cleaner environment in developed and developing countries. ISBN: 0080443516 • A. Boyle, Godfrey. Renewable energy. ISBN: 0199261784 • B. Bioenergy - a sustainable and reliable energy source. A review of status and prospects, a report for IEA Bioenergy, http://www.ieabioenergy.com/LibItem.aspx?id=6479 • R. Zito, Energy Storage: A New Approach, 1st edition, Wiley-Scrivener, 2010 • R. Huggins, Energy Storage, Springer, 2010 • T. Reddy, Linden's Handbook of Batteries, 4th Edition, McGraw-Hill, 2010 • J. Larminie, Electric Vehicle Technology Explained, 2nd edition, Wiley, 2012
Planned learning activities and teaching methods:	Students are taught the course through lectures (3 hours per week) in classrooms via projector presentations and by the use of the whiteboard. Following major lecture topics and chapters, mathematical problems and examples are solved during class. Exercises for assessed homework are also a standard practice for this course as well as at least one assignment. Lecture presentations are available for students to download via the university e-learning platform. Students are also advised to use the recommended course textbook or reference books for further reading and practice in solving related exercises. Further literature search is encouraged by assigning students to identify a specific problem related to some issue, gather relevant scientific information about how others have addressed the problem and report this information in written or orally. Students are continuously assessed and their knowledge is evaluated through tests with their assessment weight, date and time being set at the beginning of the semester via the course outline. Students are prepared for the final exam, by revision on the matter taught, problem solving and concept testing. Overall, the course assessment is both formative and summative and aims to comply with the subject's expected learning outcomes and the quality of the course.
Assessment methods and criteria:	• Assignments/Homework 10% • Tests 30% • Final Exam 60%
Language of instruction:	English
Work placement(s):	No