A holistic and Scalable Solution for research, innovation and Education in Energy Transition

D4.2 Educational programmes deployment plan

Work Package	WP4 Programmes delivery and piloting
Work Package Leader	AAU
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Executive Summary

This deliverable provides the deployment plan including deployment concept and deployment strategy for the ASSET learning offers mainly including:

- Massive open online courses (MOOCS) for university students, lifelong learning and public
- Classroom and blended short programmes
- Interdisciplinary programmes
- Courses on demand

The deployment plan encompasses the overall process of putting in place all the actions involved in getting a new educational offer up and running properly in the platform environment, including setting, running, testing, making necessary changes and promotion. In addition, it covers the timeline and planned delivery activities involved in the educational offers. Moreover, the strategy to assess the performance of educational offers and their level of satisfaction along with the potential of reusability, which is one of the key characteristics of ASSET learning offers, are also detailed within this deliverable.

For each type of educational offer, the deployment concept, strategy, mode of delivery, material preparation, promotion, and assessment are different in nature, therefore, focus on individual offers has been placed. In particular, **MOOC** deployment strategy is given more focus due to its importance as an advanced digital learning tool largely to be adopted by all energy transition stakeholders including energy citizens, which are the key drivers for taking energy transition to another level of implementation. The MOOC deployment actions have been planned, in fact, around the main goal of guiding providers to create and run their programmes on the EMMA platform. Deployment documents and actions have all been centralized around achieving the following objectives: a) to increase awareness of MOOC pedagogies and their specific instructional design, b) to define a workflow for the construction and delivery of MOOCs, as well as Learning Objects and Open Educational Resources, c) to create the necessary supporting tools and guidance both for content material and users. MOOC planning, preparation and supporting tools using the EMMA platform have been extensively discussed to highlight the effort involved in the process. Various forms including MOOC proposal form, MOOC syllabus form, and MOOC promotion forms have been included to address the level of engagement.

Under the umbrella of "**Classroom and blended shot programs**", four different modes of delivery are distinguished: a) face to face courses (as typical semester courses offered in the universities), b) seminars which are shorter than the courses, c) hands-on experience and lab-based training and d) bended programs. The target audience for classroom based short programs is generally the students of the university programmes or employees of energy companies. Looking at the individual needs of industry and university involvement, the layout for seminars and courses, the design and delivery have been discussed in detail. Since most of the programs are offered in face to face mode, the strategy to involve industrial participants and university students in practice mainly include class teaching and presentation delivery. Most of these programs are to be delivered also by the host institution based upon their semester and departmental timelines for the offering. The detailed timeline planned for the delivery of the programme is also included in the repository. The learning graph tool, learning material preparation, and learning graph approach for the fast program creation have been presented in D3.1 "Learning Graphs" and D2.3 "ASSET Learning Materials - v1 ".

One of the key objectives is to make the offer scalable and sustainable by **integrating interdisciplinary programmes** and scaling up the educational offer. Therefore, tools including learning graphs, learning materials and models for combining technology and SSH to create interdisciplinary programs are discussed along with the planning concept. The support of **on-demand courses** enables the co creation of courses and their alignment with the companies' requirements. The overall concept behind on-demand courses and the strategy along with timelines of possible delivery actions are also included in this deliverable.

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List of Acronyms

Abbreviation / acronym	Description
AAU	Aalborg University
CMS	Content Management System
EMMA	The European Multiple MOOC Aggregator
Gantt	Generalized Activity Normalization Time Table
IPR	Intellectual Property Rights
KSC	Knowledge Skills and Competencies
MOOCs	Massive Open Online Courses
OER	Open Educational Resources
RIE	Research, Innovation, and Education
SSH	Social Sciences and Humanities
UNINA	University of Naples Federico II
UNIWA	University of West Attica
OER	Open Educational Resources

1. Introduction

1.1 Purpose and scope

This document presents the work corresponding to WP4 “Programmes delivery and piloting” and is mainly devoted to actively engaging the ASSET partners, employees from energy companies of the ASSET consortium as well as university students and external, non-partner employees. For this purpose, we have developed a set of deployment documents and outlined a strategy divided into actions in order to explain and facilitate the production of the ASSET educational offer, engage the group of programmes providers and reinforce the ASSET ecosystem.

As expressed in the Description of Work, this deliverable will illustrate the “Deployment plan to serve as the basis for producing, scheduling and delivery activities and user support co-developed by tasks 4.1, 4.2, 4.3, 4.4”.

- Delivery of University Programs including MOOCs, and short courses to the students of ASSET universities as well as students outside the ASSET ecosystem in the areas of Social Sciences and Business Development along with the fields of Renewable Energy, Energy storage and the field of Smart and Flexible Energy Systems.
- Lab-based training and short courses-based engagement of employees of the energy companies of the ASSET consortium as well as adults outside ASSET in the areas of Social Sciences and Business Development along with the fields of Renewable Energy, Energy storage and the field of Smart and Flexible Energy Systems.
- Assessment of the programs offered to the University students and Industrial participants. Also, the assessment of the effectiveness of the ASSET tools and materials to validate their acceptance.

This report describes at length the organization and elaboration of ASSET’s deployment strategy for educational offers, how they have been carried out and to what purposes. It provides detailed explanations of each elaborated document and a description of the state of implementation of each action. ASSET partners have been active collaborators throughout the entire process of development of deployment policies and actions.

1.2 Structure of this deliverable

This report is organized into four main chapters according to the programmes typology along with the introduction and appendix sections. Each of these sections looks what has been done and what needs to be done during the next project time span concerning the educational programmes delivery and piloting. After the conclusion, a detailed Annex is provided which includes all the documentation that has been created concerning the deployment. The interdisciplinary programmes are based on the learning graph concept and are aimed to offer a broader learning context as described. The ad-hoc course preparation as will be requested by the project stakeholders through the marketplace is also discussed. This deliverable describes in detail all these four clusters.

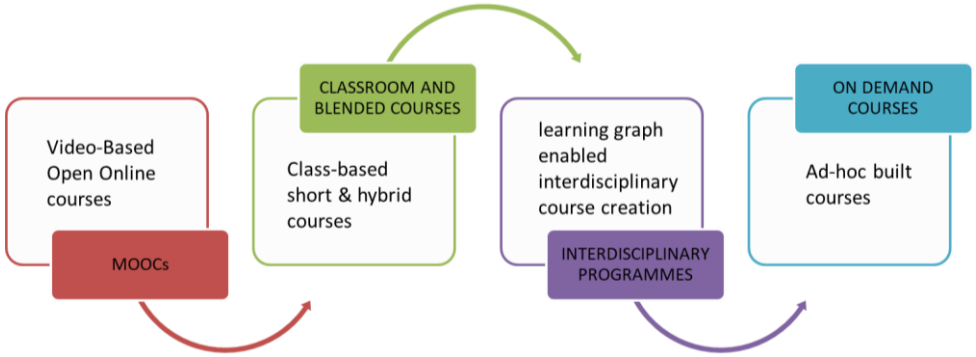

Figure 1: The organisation/structure and education offer per cluster

The overall deliverable is structured as follows:

- Section 1 provides an introduction to the document.
- Section 2 outlines the deployment plan including deployment concept, deployment strategy, and assessment method along with the contents and the timelines for MOOC offer.
- Section 3 outlines the deployment plan including deployment concept, deployment strategy, assessment method and the timelines for the classroom based short and blended programmes.
- Section 4 outlines the deployment plan including deployment concept, deployment strategy, for interdisciplinary programmes.
- Section 5 outlines the deployment plan including deployment concept, and deployment strategy, for industry on-demand programmes.
- Annex I provides the supporting tools and references for MOOC implementation.

1.3 Relation to other WPs and Tasks

This deliverable reports the deployment plan for the ASSET educational programmes. The need for these programmes is identified in WP2 “Energy transition skills identification and societal challenges” and based upon the outcomes of WP2, these programmes (structure and contents) are prepared under WP3 “Energy transition programmes preparation”. Therefore, deployment of these programmes is strongly linked to WP2 and WP3, and in particular, with the following tasks:

- All of the educational programmes are prepared based upon the KSC needed for the energy transition. The KSC assessment is based upon the methodology discussed in T2.1, “Societal challenges in the Energy Sector” and T2.2 “Skill shortage, training, and educational needs”. Therefore, input from these two tasks will be used in the learning content and programme preparation.
- Based upon the required KSC, and learning objectives, a learning graph-based model is adopted for course development. The learning graph framework for the deployment comes from the output of Task 2.3 “Framework for learning programme models in the energy sector”.
- The learning models and contents of these programmes will be prepared under T3.1 “Learning graphs and modules design for Energy Transition Programmes”, and T3.2 “Learning content preparation”. Therefore, all the delivery material for deployment comes directly as an output of these tasks.
- The assessment of programmes will be done using the monitoring tools prepared as an outcome of T2.4 “Monitoring tools” aiming at creating the tools for gathering feedback from users and from the platform in forms of analytics.
- The deployment also links with T1.1 “Network identification and outreach” strategy as the deployment plan serves as a basis to target the attending audience and outreach strategy for large-scale adoption of these programmes.

2. Deployment plan for Massive Open Online Courses (MOOCs)

2.1 Deployment concept for MOOCs

In the context of this project, deployment refers to the process of putting in place all the actions involved in getting a new educational offer up and running properly in its platform environment, including setting, running, testing, making necessary changes and promotion. According to the most updated methods of instructional design, the production of MOOC materials is a previous phase, all internal to the provider institution which is in charge of needs analysis, identification of methods, content and times of teaching delivery. If the production does not belong to the deployment itself, supporting activities, course management, monitoring as well as feedback loop are an essential part of it.

The deployment actions have been planned, in fact, around the main goal of guiding providers to create and run their programmes on the EMMA platforms. Deployment documents and actions have all been centralized around achieving the following objectives:

- To increase awareness of MOOC pedagogies and their specific instructional design.
- To define a workflow for the construction and delivery of MOOCs, as well as Learning Objects and Open Educational Resources.
- To create the necessary supporting tools and guidance both for content material and users.

All the ASSET MOOCs have been modelled based on the learning graph concept. In D2.3 the relevant learning topics, learning outcomes, and high-level description of the learning materials have been defined. In the current deliverable, we focus on the intricacies of MOOC requirements and delivery. Additionally, ASSET's Deployment Strategy proposes a series of actions with key objectives that partners of the consortium have been asked to carry out to bring the ASSET name into a wider known context with a greater base of participation from stakeholders. Actions have been divided into three categories or general aims, where each aim is associated with concrete actions

1. Involving key partners and stakeholders
2. Getting to know the ASSET educational offer
3. Attracting users to ASSET educational offer.

Section 2.2 presents the deployment strategy as designed. Each consortium partner is asked to collaborate in completing the actions that are detailed:

- MOOC deployment and activities launch through activation of courses and services fulfilment, public relation, course and contacts management, catalogue services, subscriber profile inventory, and data management.
- Policy and IPR management as well as upgrade and services control.
- MOOCs promotion.

2.2 Deployment strategy

The ASSET Deployment team is responsible for providing support to all MOOC providers in the production and delivery of MOOC activities. This includes any action to involve potential learners in the MOOC offer. To do this effectively, the UNINA team offers support to each MOOC provider based on an understanding that attracting new participants in each MOOC is the joint responsibility of all MOOC providers and the consortium as a whole whose members are all expected to help promote the ASSET Educational offers. All partners are required to offer support to the promotion of MOOC offer in specific contexts.

The main steps of the MOOC strategy are outlined below:

Step 1: The responsible person for the MOOC in the providing institution is asked to complete a basic form called the MOOC Proposal Form (A) and to send it to the ASSET Deployment team at least 10 weeks before the MOOC is launched. This form provides concerning partners with the basic information needed to start promoting the MOOC, title, description, start date, duration, language and the names of all key people responsible for this MOOC in the institution. Moreover, form A also asks for the names of the person responsible for providing institutions for the content and delivery of the MOOC and also for the person with responsibility for the promotion of the MOOC.

Step 2: The person with responsibility for the content and delivery of the MOOC will be asked to complete the MOOC Description Form (B) and to send it to UNINA at least 8 weeks before the MOOC is launched. This form provides UNINA with information about the target audience for the MOOC, what people can hope to learn, the structure of the MOOC, and accreditation options. Its contents will be used by UNINA to create the MOOC Catalogue, circulated to all partners, and create ad hoc activities for promotion. This form also allows the provider to describe what channels (including social media) will be used to ensure learners' engagement and interaction. This form also requests the availability of a short introduction video made by the institution that can be used to attract enrolments. Once the ASSET Communication and Deployment teams receive the completed form, they will ensure it is added to the project website and will support the MOOC provider in making sure the MOOC basic information is also available in the portal.

Step 3: The person with responsibility for the promotion of the MOOC will be asked to complete the MOOC Promotion Form (C) and to send it to UNINA at least 8 weeks before the MOOC is launched. This form provides concerning partners

1. With information about the channels that will be used by the MOOC provider to promote their MOOC including social media channels.
2. This form also invites the MOOC provider to clearly state how social media will be used during the MOOC to attract more enrolments and invite the provider to choose one of three options; 1. Either the person responsible for promotion takes care of ensuring there is a steady flow of content about the MOOC through the ASSET/EMMA social media channels 2. OR they commit to sending concerning partners relevant content that can be used for this purpose 3. OR they appoint a social media activist within their organization to take care of this important role.

Step 4: UNINA provides the person with responsibility for the promotion of the MOOC with the **Promotion Tips (D)** for getting the most out of existing dissemination and promotion channels.

Step 5: Based on the information provided by the MOOC provider, UNINA will create the MOOC Catalogue (E), which is a summary of available courses and a tool to be used to engage students. It will contain information about the target users for each MOOC, what people can expect to learn and will include short promotional texts that can be used by the partners in their promotion.

Deployment of MOOCs will be realized in two phases. The first wave (pilot) will be run in spring 2020 and – even though MOOCs are open to anyone – they are mainly targeted to university students since they are also the basis for blended learning classes. In autumn, the second wave of MOOC is expected by the reiteration of all MOOCs available. This reiteration - even though available to university students - is mainly targeted to energy workers, employees, and citizens. In the following tables, basic information is organized per each MOOC according to their delivery date. The result of this activity is Table 55. i.e. the MOOC Generalized Activity Normalization Timetable (Gantt).

2.3 Supporting tools and references

Support for MOOC implementation and evaluation aims at assisting MOOC providers regarding MOOC preparation and dissemination using predefined templates (see the Annex 1). This process is supported by ASSET partners: UNINA gives access to the EMMA platform and technological issues, UNIWA and ATOS assist partners to access the ASSET Platform and Tools; and LS assists partners for Programme dissemination. All other partners contribute through using the platform for content delivery and providing feedback to improve the experience in the upcoming waves of MOOC.

MOOC Proposal Template: template providing information about providers, their MOOC, and their technical requirements.

MOOC Description Template: template to be filled out by MOOC providers to provide a short and targeted MOOC description for communication purposes.

MOOC Syllabus template: template to help MOOC provider to fulfil required CMS fields.

Furthermore, some supporting tools are already available on the EMMA platform since they were developed during the previous European MOOCs project (EMMA). Concretely, a ZENDESK section has been created within the EMMA platform to help and assist users (see next section) while the Annex 1 - MOOC provider workflow - is a special chapter devoted to helping providers during the process of designing their own MOOC.

This next session offers a set of simple tips to guide the teacher/tutor through the process of creating a MOOC, laying out steps to follow to save time and maximize the EMMA MOOC experience

2.3.1 Creating a MOOC on EMMA: Pedagogy and Media Design

This session is an explanation of tools & tips available for the ASSET teacher and tutors about the EMMA's pedagogical and technological approach. It includes the EMMA webinar series (currently being organized, (see Table 1). The objective is to provide a series of one-hour webinars on how to produce a MOOC for EMMA that we can use to display the expertise of the partnership as well as to encourage on demand design of new MOOCs on EMMA.

Before getting started, we recommend the teacher to:

1. Request authoring username(s) and password(s):

Send email to support@europeanmoocs.eu introducing yourself and request a username and password for all staff who will be authoring and teaching the course and - eventually - request access to translation tutorials on the EMMA platform. You will receive a reply email with all usernames and passwords requested.

2. Go through an EMMA MOOC as a user:

Register for and complete the EMMA A---Z tutorial for users to see what guidance EMMA users are given and/or register on an EMMA MOOC if you have not already done so.

Register for and complete EMMA's A---Z Teacher Tutorial MOOC (review best practice guide that can be found in Unit 1 "pedagogic technique").

3. Go through EMMA information material as an instructional designer/teacher. Answer the following questions to better prepare your MOOC:
    - What languages will you deliver your MOOC in?
    - What MOOC design and interaction patterns will you use in a multilingual learning context?
    - How will you offer tutor provision in a multilingual context?
    - What training does your staff need to have to optimize their use of EMMA and how will you meet these?

- What is your target number of enrollments you hope to attract?
- At what stage is your MOOC?
  - Is this the first time you are going to run it?
  - Has it been run on another platform before?
- What channels can you use to attract people to enroll in your MOOC?
  - Who is responsible for your team for disseminating information about your MOOC?

EMMA provides a series of guides, tutorials, and manuals for providers as well as users which we hope gives you the necessary information to be almost self---sufficient in your MOOC authoring. EMMA also has activated a Zen Helpdesk Service that the EMMA technical team compiled on the basis of their experience of troubleshooting during the preparation of earlier rounds of MOOCs from internal providers and user requests for help.

The **EMMA A---Z Teacher Tutorial** has been created by UNINA to provide step by step instructions on how to create your MOOC and put it onto the platform. It comprises 6 lessons that provide manageable chunks of learning content in the form of video tutorials, text---based guides, as well as links to relevant open educational resources (OER), many of which are written by EMMA consortium members. As with all guides that accompany agile and evolving platforms, the UNINA team does its best to keep the tutorials updated with recent changes to the platform but, of course, there may be occasional details that are no longer relevant.

- **The first lesson** is called Pedagogic techniques. The different units provide information and pointers on best practices:

A compilation of practical guidelines based on the experience of EMMA providers are given as below:

Teaching techniques: reminders of how to vary your MOOC format and include a variety of classroom techniques and activities into the virtual learning environment

Tutor/facilitator tips: a review of techniques for engaging and retaining users through the strategic use of interaction and communication features including social networks.

EMMA platform tracking: runs you through the reasons why LA can help improve the teaching and learning process and provides information on the actions and learning activity that the EMMA teacher and student dashboards provide information on the following.

- **The second lesson** is Authoring a course on EMMA and takes you into the EMMA CMS and offers information and tutorials on every step from the syllabus to course, through the cover page, lesson, unit and the different forms of assignment and assessment available.
- **The third lesson** sees us on the EMMA front end and is a guide to navigation through the different course and interaction features available.
- **The fourth lesson** provides an overview of how EMMA supports personal learning and explores some of the features like blogs, profiles, and coursebooks.

Last, but not least, the tutorials in lessons 5 and 6 provide information on how to approach the revision of video transcriptions and translations as well as text translations.

You will also find a link that enables you to download a set of simplified, infographic guides[1] that steer you through the authoring process and give pointers as to which interaction and assessment features will work best for you

There is also a detailed user manual (D4.1) available to MOOC authors in the ASSET repository.

[1]EMMA Set of simplified guides **http://platform.europeanmoocs.eu/guide/EMMA-Teacher-Infographic-Guide.pdf**

A webinar series has been planned as in Table 1:

Webinars			
No.	Title	Date	Target group
1	Introducing partners to the Emma platform features	17.09.2019	MOOC providers
2	MOOC Design and CMS	February 2020 (Date to be defined)	MOOC providers
3	Use the social classroom and Interactive features to engage your students and promote your course	March 2020 (Date to be defined)	MOOC providers
4	Explain ASSET objectives and offer to external stakeholders	April 2020 (Date to be defined)	Energy companies, institutional stakeholders
5	Explain Energy transition MOOC to society at large	April 2020 (Date to be defined)	Society at large
6	Engage stakeholders in MOOC design & demand	October 2020 - Date to be defined	Energy companies, institutional stakeholders

Table 1: List of ASSET MOOC Webinar Series

2.4 Preparing MOOC and EMMA

The following are 17 proposal forms of ASSET partners related to their MOOC offer. Information collected will be used to create a course page and to understand the nature, level, and target of each course. In the collected information, some of the partners have already planned their delivery schedules for each lesson and each unit, while others are in the phase of planning for unit wise/ lesson wise schedules. For those courses, which do not have yet planned the dates of delivery for each of the lessons and units, we have provided the overall course start and end date while kept the lesson dates as blank to maintain the symmetry of the document.

2.4.1 Courses programmes proposals

GENERAL INFO	
MOOC Title	**An Introduction to AC Microgrids for Energy Control and Management**
Providing Institution	**Aalborg University (AAU)**
Description	A microgrid is an electrically interconnected network of distributed energy resources including renewable/non-renewable generation resources, storage

	and loads in a closed locality to enhance the reliability, and efficiency of generation, distribution and utilization. The modules of the course are dedicated to the overview of microgrid technology giving some Microgrids examples around the world and how power electronics converters are integrated to form AC pico, nano, and smart Microgrids. DOMAIN: Smart and Flexible Energy Systems PEDAGOGY: Each lesson will be articulated as follows: ● Video ● Slides ● Readings list ● Simulation Handbook and Exercises ● Multi-choice test and report-based Evaluation There will be a forum for communication and discussions with peers and other fellows enrolled in the course. LEARNING OUTCOMES/OBJECTIVES ● Illustrate the concepts of distributed AC power systems and microgrids. ● Define and explain various configurations and applications of AC microgrid systems. ● Design various control schemes for power electronic converters employed in AC microgrids including voltage source inverter (VSI) ● Illustrate how power electronics converters are integrated to form AC pico, nano and smart Microgrids with their operation and control in grid-connected and islanded mode LESSONS OUTLINE 1st Week - Introduction to Microgrids ● Distributed Renewable/Non-renewable Energy Resources ● Overview of Microgrid Technology ● Microgrid Configurations and Examples 2nd Week - Introduction to AC Microgrids ● Configurations and Architectures of AC Microgrids ● AC Microgrid Applications and Example Projects ● Storage Systems and UPS Systems 3rd Week – Voltage Source Inverter (VSI) as an integral component of AC Microgrids ● Design of Control Loops for VSIs ● Evaluation of a Stand-alone VSI with Voltage Control 4th Week – Modes of operation for AC Microgrids ● Grid Connected Mode of operation ● Islanded Mode of Operation
Duration in	4 weeks

Weeks	
Total participant workload in hours	maximum of 4 hours per week
Course format	Each module has a set of lecture slides and suggested readings (Book Chapters, research papers MSc, Ph.D. thesis). Along with this, some modules have simulation exercises for which MATLAB is required. The theoretical understanding of the modules will be evaluated through multi-choice questions, simulation exercises will be evaluated based on the reports.
Primary Language of Delivery	English
Preferred language(s)	English
Teacher's short bio	Prof. Josep M. Guerrero Josep M. Guerrero received a B.S. degree in telecommunications engineering, an M.S. degree in electronics engineering, and a Ph.D. degree in power electronics from the Technical University of Catalonia, Barcelona, Spain. He was an Associate Professor at the same university, where he teaches courses on digital signal processing, control theory, and renewable energy systems. Since 2004, he has been responsible for the Renewable Energy Lab, Escola Industrial de Barcelona. His research interests include photovoltaics, wind energy conversion, uninterruptible power supplies, storage energy systems, and microgrids. He has been a visiting Professor at Zhejiang University 浙江大学 (China). From 2011, he became a full Professor in Microgrids at Aalborg University. Dr. Guerrero is an Associate Editor of the IEEE Transactions on Industrial Electronics, the IEEE Transactions on Power Electronics, the IEEE Industrial Electronics Magazine, and the Editor-in-Chief of the International Journal of Integrated Energy Systems. Currently, he is the Chair of the IEEE Industrial Electronics Society Technical Committee on Renewable Energy Systems. Prof. Juan C. Vasquez Juan C. Vasquez (M'12-SM'14) received the B.S. degree in electronics engineering from the Autonomous University of Manizales, Manizales, Colombia, and the Ph.D. degree in automatic control, robotics, and computer vision from the Technical University of Catalonia, Barcelona, Spain, in 2004 and 2009, respectively. He was with the Autonomous University of Manizales working as a teaching assistant and the Technical University of Catalonia as a Post-Doctoral Assistant in 2005 and 2008 respectively. In 2011, he was Assistant Professor and from 2014 he is working as an Associate Professor at the

	Department of Energy Technology, Aalborg University, Denmark where he is the Vice Program Leader of the Microgrids Research Program (see microgrids.et.aau.dk). From Feb. 2015 to April 2015 he was a Visiting Scholar at the Center of Power Electronics Systems (CPES) at Virginia Tech and a visiting professor at Ritsumeikan University, Japan. His current research interests include operation, advanced hierarchical and cooperative control, optimization and energy management applied to distributed generation in AC/DC Microgrids, maritime microgrids, and the integration of the Internet of Things and Cyber-Physical Systems into the Smart Grid. He has authored and co-authored more than 100 technical papers only in Microgrids in international IEEE conferences and Journals. Dr. Yajuan Guan Yajuan Guan (S'14) received a B.S. degree and an M.S. degree in Electrical Engineering from the Yanshan University, Qinhuangdao, Hebei, China, in 2007 and 2010 respectively. From 2010 to 2012, she was an Assistant Professor in the Institute of Electrical Engineering (IEE), Chinese Academy of Sciences (CAS). Since 2013, she has been a Lecturer in IEE; CAS. She is currently working as an Assistant Professor at the Department of Energy Technology, Aalborg University, Denmark, Her research interests include microgrids, distributed generation systems, power converter for renewable energy generation systems, and ancillary services for microgrids.
OTHER DETAILS	
Envisioned starting date	October 15, 2020
MOOC background	● The extended version of this course in the class-based mode is available at the Department of Energy Technology at Aalborg University, Centre for Research on Microgrids CROM. https://www.crom.et.aau.dk/phd-industrial-courses/ ● The participants of this course will be invited to register class-based courses for extended learning and hands-on laboratory-based training on AC microgrids modeling control and optimization. ● Another related online course on Solar Energy: Integration of Photovoltaic Systems in Microgrids is available on edX, however, this course focuses only on photovoltaics and solar energy integration in microgrids. ● https://courses.edx.org/courses/course-v1:DelftX+PV4x+1T2018/9dd3042a74b24b8cbd99306e91a591b9/

Target MOOC audience	This course is targeted for Employees of industries and energy companies, trainers and students from electrical engineering and energy technology institutions along with all other individuals interested in the topic and willing to promote AC microgrid technology for green/renewable energy transition.
Participants requirements	Basic knowledge (undergraduate level) in electrical circuits, control theory, power electronics, and MATLAB Simulink.
License	CC
Special requirements	no
CONTACT PERSON	
Name	Mashood Nasir
email address	mnas@et.aau.dk

Table 2: Program Proposal: An Introduction to AC Microgrids for Energy Control and Management

GENERAL INFO	
MOOC Title	**Power Quality Challenges and Solutions for Microgrids**
Providing Institution	**Aalborg University (AAU)**
Description	Microgrids are deemed as one of the main building blocks of the smart grids; since they are able to facilitate the implementation of many smart grid functions. On the other hand, the proliferation of different nonlinear and single-phase loads in electrical systems has resulted in voltage harmonics and unbalance as two common power quality problems. In addition, harmonic resonances can be excited giving rise to a significant increase of the voltage distortion. These phenomena can cause a variety of problems such as protective relays malfunction, overheating of motors and transformers and failure of power factor correction capacitors. Therefore, in this course, measurement, compensation, and damping of such power quality problems will be addressed through several basic control methodologies.

	This course is aimed to enhance the awareness and technical background of individuals striving for power quality improvement in microgrids for large-scale integration of renewable energy resources and electric vehicles. DOMAIN: Smart and Flexible Energy Systems PEDAGOGY: Each lesson will be articulated as follows: · Videos · Slides · Readings list · Simulation Handbook and Exercises · Multi-choice test and report-based Evaluation There will be a forum for communication and discussions with peers and other fellows enrolled in the course. LEARNING OUTCOMES/OBJECTIVES ● Illustrate power quality problems including harmonics, power-frequency deviations, voltage fluctuations, voltage dips, swells, interruptions, and voltage unbalance. ● Apply various techniques for power quality improvement in microgrids including active power Injection, reactive power-sharing, harmonic current sharing and voltage regulation via smart loads. ● Design virtual impedance loops for load sharing and power quality Improvement LESSONS OUTLINE 1st Week – Introduction to Power Quality Issues in AC Microgrids ● Harmonics ● Power-Frequency Deviations ● Voltage Fluctuations ● Voltage Dips, Swells, and Interruptions ● Voltage Unbalance 2nd Week - Harmonic Compensation and Reactive Power Sharing in Microgrids ● Active Power Injection & Voltage Regulation ● Reactive Power Sharing Problem & Voltage Regulation ● Voltage Regulation via Smart Loads 3rd and 4th Week – Virtual Impedances for Power Quality Issues ● Virtual Impedance Concept ● Primary Harmonic Sharing via Inner Control Loops
Duration in Weeks	4 weeks

Total participant workload in hours	maximum of 4 hours per week
Course format	Each module has a set of lecture slides and suggested readings (Book Chapters, research papers MSc, Ph.D. thesis). Along with this, some modules have simulation exercises for which MATLAB is required. The theoretical understanding of the modules will be evaluated through multi-choice questions and the simulation exercises will be evaluated based on the reports.
Primary Language of Delivery	English
Preferred language(s)	English
Teacher's short bio	Dr. Alexander Micallef Alexander Micallef received the B.Eng. (Hons.) degree, the M. Sc. in Engineering degree and a Ph.D. in Engineering from the University of Malta, Malta in 2006, 2009 and 2015, respectively. He is currently a lecturer with the Department of Industrial Electrical Power Conversion (IEPC) at the University of Malta. He has 10+ years (2008 – Present) of professional experience lecturing with IEPC. Dr. Micallef is an Associate Editor for IEEE Access and the IET Smart Grids journal. He is a senior member of IEEE and is involved in activities of the IEEE PES SBLCS Technical Committee. His research interests include renewable energy systems, control, and management of distributed generation and energy storage systems, AC and DC microgrids. Dr. Mehdi Savaghebi Mehdi Savaghebi received a B.Sc. degree from the University of Tehran, Iran, in 2004 and the M.Sc. and Ph.D. degrees with highest honors from Iran University of Science and Technology, Tehran, Iran in 2006 and 2012, respectively, all in Electrical Engineering. From 2014 to 2017, he was a Postdoc Fellow in the Department of Energy Technology, Aalborg University where he was an Associate Professor for 2017-2018. Currently, he is an Associate Professor with the Electrical Engineering Section, the Mads Clausen Institute, University of Southern Denmark, Odense, Denmark. His main research interests include distributed generation systems, microgrids, power quality and protection of electrical systems UPS systems. Dr. Savaghebi is an Associate Editor of IEEE Access, a member of the Technical Committee of Renewable Energy Systems, IEEE Industrial Electronics Society as well as Vice-Chair of sub-committee on Smart Buildings, IEEE Power and Energy Society.
OTHER DETAILS	

Envisioned starting date	October 15, 2020
MOOC background	The extended version of this course in the class-based mode is available at the Department of Energy Technology at Aalborg University, Centre for Research on Microgrids CROM. https://www.crom.et.aau.dk/phd-industrial-courses/ The participants of this course will be invited to register the class-based advanced course for the extended learning and hands-on laboratory-based training on DC microgrids modeling control and optimization. Another related online course on Power Quality i.e. Power Quality in Power Distribution Systems is available on NPTEL, however, this course focuses only on power quality issues with a distribution system without focusing on the power quality issues due to the high penetration of PV Wind and electric vehicles. https://nptel.ac.in/courses/108/106/108106025/
Target MOOC audience	This course is targeted for Employees of industries and energy companies, trainers and students from electrical engineering and energy technology institutions along with all other individuals interested in the topic and willing to contribute to power quality issue mitigation arises due to high penetration of green and renewable energy resources
Participants requirement	Basic knowledge (undergraduate level) in electrical circuits, control systems, power electronics, and MATLAB simulations.
License	CC
CONTACT PERSON	
Name	Mashood Nasir
email address	mnas@et.aau.dk

Table 3: Programme Proposal: Power Quality Challenges and Solutions for Microgrids

GENERAL INFO	
Name of MOOC	**Maritime Microgrids – A Sustainable Solution for Green Sea Transportation**
Providing	**Aalborg University (AAU)**

Institution	
Description	Nowadays, an important kind of terrestrial islanded microgrids can be found in Maritime power systems. For example, under normal operating conditions, the ship power system can be considered as a typically isolated microgrid and its characteristics, including variable frequency, match to terrestrial islanded microgrids. This course provides an overview of the present and future architectures of maritime microgrids, associated control technologies, optimization methods, power quality issues and state of the art solutions. The significant role of power electronics in realizing maritime microgrids, challenges in meeting high power requirements and regulations in the maritime industry, state-of-the-art power electronic technologies and future trends are also presented in this course. This course is aimed to enhance the awareness and technical background of individuals working on sustainable maritime power systems and their applications. DOMAIN: Smart and Flexible Energy Systems PEDAGOGY: Each lesson will be articulated as follows: · Videos · Slides · Readings list · Simulation Handbook and Exercises · Multi-choice test and report based Evaluation There will be a forum for communication and discussions with peers and other fellows enrolled in the course.
	LEARNING OUTCOMES/OBJECTIVES : ● Illustrate the shipboard power system and integrated electric applications in ships. ● Analyse maritime microgrid characteristics and power quality challenges in shipboard microgrid power systems ● Categorize the ship's power systems evolution and identify the directions for future research challenges. LESSONS OUTLINE 1st Week - Introduction to Microgrids ● Distributed renewable/non-renewable energy resources ● Overview of Microgrid Technology ● Microgrid Configurations and Examples 2nd Week – Introduction to Ships power system

	• Ships power system evolution • Shipboard electrical applications 3rd Week - Shipboard Microgrid configurations • The Current war (AC v/s DC) • Comparison between AC and DC Shipboard Microgrids 4th Week - Power Quality Challenges in Shipboard Microgrids • Introduction to Power Quality in Maritime Microgrids • Power quality assessment in marine microgrids • Recommendations for measurement of PQ disturbances in maritime microgrids
Duration in Weeks	4 weeks
Total participant workload in hours	maximum of 4 hours per week
Course format	Each module has a set of lecture slides and suggested readings (Book Chapters, research papers MSc, Ph.D. thesis). Along with this, some modules have simulation exercises for which MATLAB is required. The theoretical understanding of the modules will be evaluated through multi-choice questions and the simulation exercises will be evaluated based on the reports.
Primary Language of Delivery	English
Preferred language(s)	English
Teacher's short bio	Prof. Josep M. Guerrero Received the B.S. degree in telecommunications engineering, the M.S. degree in electronics engineering, and the Ph.D. degree in power electronics from the Technical University of Catalonia, Barcelona, Spain. He was an Associate Professor at the same university, where he teaches courses on digital signal processing, control theory, and renewable energy systems. Since 2004, he has been responsible for the Renewable Energy Lab, Escola Industrial de Barcelona. His research interests include photovoltaics, wind energy conversion, uninterruptible power supplies, storage energy systems, and microgrids. He has been a visiting Professor at Zhejiang University 浙江大学 (China). From 2011, he became a full Professor in Microgrids at Aalborg University. Dr. Guerrero is an Associate Editor of the IEEE Transactions on Industrial Electronics, the IEEE Transactions on Power Electronics, the IEEE Industrial Electronics Magazine, and the Editor-in-Chief of the International Journal of Integrated Energy Systems. He is involved on several IEEE IES Committees, and he usually chairs

	and organizes sessions in IES and PELS conferences. Currently, he is the Chair of the IEEE Industrial Electronics Society Technical Committee on Renewable Energy Systems. Prof. Tomasz Tarasiuk Tomasz Tarasiuk received the M.S. degree in marine electrical engineering from the Gdynia Maritime University in 1989, the Ph.D. degree in electrical engineering from the Gdansk University of Technology in 2001, and the D.S. degree in electrical engineering (metrology and signal processing) from Warsaw University of Technology in 2010. He has been employed by the Gdynia Maritime University since 1994. He is the vice dean of the electrical engineering department of Gdynia Maritime University. His research interests include power quality analysis, assessment and signal processing methods applied to maritime microgrids. Dr. Giorgio Sulligoi Giorgio Sulligoi received the M.S. degree (with honors) in electrical engineering from the University of Trieste, Trieste, Italy, in 2001, and the Ph.D. degree in electrical engineering from the University of Padua, Padua, Italy, in 2005. He spent an internship at Fincantieri Electric Systems Office (Trieste), and a semester as a Visiting Scholar at the University College of Cork (Ireland). In 2005, he joined MAI Control Systems, Milan, Italy, an Italian firm operating in the field of power stations and alternator voltage control systems. Since 2007, he has been an Assistant Professor of electric power generation and control in the Department of Engineering and Architecture, University of Trieste, Trieste, Italy. He is a member of PES, where he serves in the MARSYS committee.
OTHER DETAILS	
Envisioned starting date	October 15, 2020
MOOC background	The extended version of this course in the class-based mode is available at the Department of Energy Technology at Aalborg University, Centre for Research on Microgrids CROM. https://www.crom.et.aau.dk/phd-industrial-courses/ The participants of this course will be invited to register the class-based advanced course for the extended learning and hands-on laboratory-based training on DC microgrids modeling control and optimization.
Target MOOC audience	This course is targeted for Employees of industries and energy companies, trainers and students from electrical engineering and energy technology institutions along with all other individuals interested in maritime power systems.

Participants requirements	Basic knowledge (undergraduate level) in mathematics, electrical engineering, power systems and simulation tools including MATLAB.
License	CC
CONTACT PERSON	
Name	Mashood Nasir
email address	mnas@et.aau.dk

Table 4: Programme Proposal: Maritime Microgrids – A Sustainable Solution for Green Sea Transportation

GENERAL INFO	
Name of MOOC	**Optimization Strategies and Energy Management Systems**
Providing Institution	**Aalborg University (AAU)**
Description (subject, domain, pedagogy, learning outcomes/objectives, the outline of lessons if possible, summary syllabus)	Energy is a resource that needs to be managed and decisions need to be made on production, storage, distribution and consumption of energy. Participants attending this course will learn how to recognise and formulate different optimization problems in operation management, and control of energy systems, and how to solve them using existing software and solvers. Different principal algorithms for the linear, network, discrete, and dynamic optimization are introduced and related methodologies together with underlying mathematical structures are described accordingly. Several illustrative will be used for solving several real-world use cases. **DOMAIN**: Smart and Flexible Energy Systems **PEDAGOGY:** Each lesson will be articulated as follows: • Slides • Readings list • Simulation Handbook and Exercises • Multi-choice test and report-based Evaluation There will be a forum for communication and discussions with peers and other fellows enrolled in the course. **LEARNING OUTCOMES/OBJECTIVES**: • Relate process system engineering with the focus on modelling and optimization techniques used in power systems. • Apply different optimization tools for continuous, semi continuous and discrete optimization problems in energy systems and implement them using Excel, MATLAB or GAMS.

	• Design and implement the schemes of Supply side and demand/load side management including peak shaving and load control/ load shifting programmes. **LESSONS OUTLINE** 1st Week – Introduction to Process Engineering and Energy Management ConceptProcess system engineering (PSE) • Interlink between PSE and energy management systems (EMS) • Energy Management in Microgrids and smart grids 2nd Week– Introduction to Energy System Modelling and Optimization • Linear Programming • Quardatic Programming • Mixed Integer Linear Programming (MILP) 3rd Week – Introduction to efficient modelling systems and optimization tools for EMS • EXCEL • MATLAB • GAMS 4th Week – Optimization Applications in Microgrids and Smart Grids • Peak shaving • Generation/Supply Side Management • Demand/Load Side Management
Duration in Weeks	4 weeks
Total participant workload in hours	maximum of 4 hours per week
Course format	Each module has a set of lecture slides and suggested readings (Book Chapters, research papers MSc, Ph.D. thesis). Along with this, some modules have simulation exercises for which EXCEL/ MATLAB is required. The theoretical understanding of the modules will be evaluated through multi-choice questions and the simulation exercises will be evaluated based on the reports.
Primary Language of Delivery	English
Preferred language(s)	English
Teachers + short bio	**Dr. Moisès Graells** Moisès Graells is an Associate Professor of Chemical Engineering at Universitat Politècnica de Catalunya (UPC). He holds a degree in Chemical Science from Universitat Autònoma de Barcelona (UAB, 1989). After a brief experience in high school and industry, he was granted by FI/DGU (Generalitat de Catalunya) and obtained his Ph.D. in 1996 at UPC. His thesis on Process Systems Engineering was supervised by Prof. Luis Puigjaner.

	His research interests have focused on the modeling and optimization of chemical processes, especially batch processes, and also on process integration, waste management, and scheduling and planning. Regarding methodological aspects, his interests are the modeling and optimization techniques: math programming, stochastic and metaheuristic algorithms, artificial intelligence, computer aided tools for decision making, and information management and standardization. **Dr. Eleonora Riva Sanseverino** Eleonora Riva Sanseverino received an M.S. degree in electrical engineering, and a Ph.D. degree in electrical engineering from the University of Palermo, Italy, in 1995 and 2000, respectively. She is an Associate Professor with the Department of Electrical and Electronic Engineering and Mathematics, DEIM at UNIPA, where she currently teaches courses on power distribution, building automation and intelligent systems. During her Ph.D. she took part in the DIADIC research group on Genetic Algorithms at the School of Electrical Engineering and Computer Science at the Washington State University, WA, USA, under the guidance of Prof. Hillol Kargupta. She is responsible for different research projects and scientific cooperation agreements: with the national research center ENEA; with the Institute of Energy Science, Hanoi (VN); with the university EPU, Hanoi, VN. She is Rector's delegate for young researchers' education and researchers' career support. Her research interests are oriented to different power distribution systems aspects, mostly to energy management systems, the application of soft computing techniques to different engineering problems, problem formulation, and variables coding.. **Najmeh Bazmohammadi** Najmeh Bazmohammadi received the B.S. degree in electronics engineering and the M.S. degree in Control Engineering from Ferdowsi University of Mashhad, Iran. Currently, she is a Ph.D. candidate at K.N. Toosi University of Technology, Tehran, Iran. Since December 2017, she has been a Ph.D. guest student at the Department of Energy Technology, Aalborg University, Denmark. Currently, she is working as a research assistant at the Department of Energy Technology, Aalborg University, Denmark. Her research key areas involve distributed and hierarchical control, energy management systems of renewable-based microgrids and multi-microgrid systems, Stochastic and Economic Model predictive control, System Dynamics modelling, stochastic optimization, and artificial intelligence.
OTHER DETAILS	
Envisioned starting date	October 15, 2020
Accreditation possibilities	
MOOC background, for example:	• The extended version of this course in the class-based mode is available at the Department of Energy Technology at Aalborg University, Centre for Research on Microgrids CROM. https://www.crom.et.aau.dk/phd-industrial-courses/

-Example of a (similar) course? Provide URL -Already offered face-to-face or online? (Where? to whom? additional observations) -On another MOOC platform? -Planned future face-to-face and /or online activities?	• The participants of this course will be invited to register the class-based advanced course for the extended learning and hand-on laboratory-based training on DC microgrids modelling control and optimization.
Target MOOC audience	This course is targeted for Employees of industries and energy companies, trainers and students from electrical engineering and energy technology institutions along with all other individuals interested in energy auditing, energy efficiency, and energy planning.
Participants requirements/ prior knowledge needed?	Basic knowldge (undergraduate level) in mathematics, power systems and simulation tools including GAMS or MATLAB.
License (CC/ all rights protected)	CC
Reason(s) for wanting to publish on EMMA	This course is aimed to enhance the awareness and technical background of individuals working for energy auditing, energy planning, and energy conservation.
Special requirements	No
CONTACT PERSON	
Name	Mashood Nasir
email address	mnas@et.aau.dk

Table 5: Programme Proposal: Optimization Strategies and Energy Management Systems

GENERAL INFO

MOOC Title	**An Introduction to DC Microgrids for Energy Control and Management**
Providing Institution	**Aalborg University (AAU)**
Description	A microgrid is an electrically interconnected network of distributed energy resources including renewable/non-renewable generation resources, storage and loads in a closed locality to enhance the reliability, and efficiency of generation, distribution and utilization. DC has paved its way in Datacenter, Electrical vehicles and Telecommunication stations due to higher distribution efficiency and better reliability aspects. Moreover, clean energy technologies e.g. Solar PV, Fuel Cells, battery storage systems and electronic loads are inherently DC in nature. Therefore, DC distribution and DC microgrids are clear trends in electrical networks. The focus of this course is on the understanding of DC microgrids, its configurations, and applications. The course also focuses on the introduction to modeling, control, and operation of DC Microgrids. This course is aimed to enhance the awareness and technical background of individuals striving for a green energy transition, climate change and large-scale adoption of renewable energy resources. DOMAIN: Smart and Flexible Energy Systems PEDAGOGY: Each lesson will be articulated as follows: ● Slides ● Readings list ● Simulation Handbook and Exercises ● Multi-choice test and report-based Evaluation There will be a forum for communication and discussions with peers and other fellows enrolled in the course. LEARNING OUTCOMES/OBJECTIVES: ● Recognize understand the importance of DC Microgrids as a reliable, resilient and efficient technology for the integration, distribution, and utilization of renewable/non-renewable based generation and storage resources. ● Illustrate various architectures, configurations, and applications of DC Microgrids at the residential, commercial and industrial levels. ● Design various control schemes for individual power electronic converters and multiple parallel converters for DC microgrids operation. LESSONS OUTLINE 1st Week - Introduction to Microgrids ● Distributed renewable/non-renewable energy resources ● Overview of Microgrid Technology

	● Microgrid Configurations and Examples 2nd Week - Introduction to DC Microgrids ● The Current war (AC v/s DC) ● Comparison between AC and DC Microgrids ● Advantages of DC Microgrids 3rd Week - DC Microgrid Configurations and Applications ● Configurations and Architecture of DC Microgrids ● DC Microgrid Applications ● DC Microgrid Example Projects 4th Week- Basic Control Theory for DC Microgrids ● Voltage and Current Loops ● Droop Control
Duration in Weeks	4 weeks
Total participant workload in hours	maximum of 4 hours per week
Course format	Each module has a set of lecture slides and suggested readings (Book Chapters, research papers MSc, Ph.D. thesis). Along with this, some modules have simulation exercises for which MATLAB is required. The theoretical understanding of the modules will be evaluated through multi-choice questions and the simulation exercises will be evaluated based on the reports.
Primary Language of Delivery	English
½Teacher's short bio	Prof. Josep M. Guerrero Received a B.S. degree in telecommunications engineering, an M.S. degree in electronics engineering, and a Ph.D. degree in power electronics from the Technical University of Catalonia, Barcelona, Spain. He was an Associate Professor at the same university, where he teaches courses on digital signal processing, control theory, and renewable energy systems. Since 2004, he has been responsible for the Renewable Energy Lab, Escola Industrial de Barcelona. His research interests include photovoltaics, wind energy conversion, uninterruptible power supplies, storage energy systems, and microgrids. He has been a visiting Professor at Zhejiang University 浙江大学 (China). From 2011, he became a full Professor in Microgrids at Aalborg University. Dr. Guerrero is an Associate Editor of the IEEE Transactions on Industrial Electronics, the IEEE Transactions on Power Electronics, the IEEE Industrial Electronics Magazine, and the Editor-in-Chief of the International Journal of Integrated Energy Systems. He is involved in several IEEE IES Committees, and he usually chairs and organizes sessions in IES and PELS conferences. Currently, he is the Chair of

	the IEEE Industrial Electronics Society Technical Committee on Renewable Energy Systems. Dr. Mashood Nasir Mashood Nasir received his BS degree in Electrical Engineering from UET Lahore, Pakistan and MS in Electrical Engineering from UMT Lahore, and Ph.D. in Electrical Engineering from Lahore University of Management Sciences, Pakistan in 2009 and 2011, and 2018 respectively. From 2011 to 2012, he served as a lecturer and from 2013-2014 he served as an assistant professor in the Electrical Engineering department at UMT, Lahore. From May 2017 to Nov 2017 he was a visiting Ph.D. researcher at the Microgrid Laboratory in Aalborg University Denmark. From 2018-2019 he served as an assistant professor at Lahore University of Management Science. Currently, he is a postdoctoral research fellow at Aalborg University Denmark. His research interests mainly include but not limited to power electronics, electrical machines and drives, grid integration of alternate energy resources, electrochemical energy conversion and battery storage systems and AC/DC/Hybrid microgrids.
OTHER DETAILS	
Envisioned starting date	October 15, 2020
MOOC background	The extended version of this course in the class-based mode is available at the Department of Energy Technology at Aalborg University, Centre for Research on Microgrids CROM. https://www.crom.et.aau.dk/phd-industrial-courses/ The participants of this course will be invited to register the class-based advanced course for the extended learning and hands-on laboratory-based training on DC microgrids modeling control and optimization. Another related online course on Solar Energy: Integration of Photovoltaic Systems in Microgrids is available on edX, however, this course focuses only on photovoltaics and solar energy integration in microgrids. https://courses.edx.org/courses/course-v1:DelftX+PV4x+1T2018/9dd3042a74b24b8cbd99306e91a591b9/
Target MOOC audience	This course is targeted for employees of industries and energy companies, trainers and students from electrical engineering and energy technology institutions along with all other individuals interested in the topic and willing to promote DC microgrid technology for green/renewable energy transition.
Participants requirements	Basic knowledge (undergraduate level) in electrical circuits, control theory, power electronics, and MATLAB simulink.
License	CC

Special requirements	no
CONTACT PERSON	
Name	Mashood Nasir
email address	mnas@et.aau.dk

Table 6: Programme Proposal: An Introduction to DC Microgrids for Energy Control and Management

GENERAL INFO	
Name of MOOC	**Challenges and solutions in Future Power Networks**
Providing Institution	**RWTH**
Description (subject, domain, pedagogy, learning outcomes/objectives, the outline of lessons if possible, summary syllabus)	By participating in this training course, you will keep up with trends, getting an insight into the most innovative energy and ICT solutions developed for the power network of the future.
Duration in Weeks	*Suggested up to 9-10 weeks*
Total participant workload in hours (course + homework)	*max 4.5 hours per week*
Course format (levels of interaction, text-based syllabus, pre-recorded videos, live webinars, podcasts, presentations, discussions, etc.)	Video lectures are provided per each unit.
Primary Language of Delivery	English
Preferred language(s) to be included as a	

translation and transcription option	
Teachers + short bio	The MOOC was prepared by a team expert in the field of advanced control and monitoring systems for power systems, who are working at the Institute for Automation of Complex Power Systems in RWTH Aachen University. The team members are Univ.-Prof. Antonello Monti, Ph.D.; Gianluca Lipari, Ph. D.; David Raisz Ph. D.; Sriram Karthik Gurumurthy, M. Sc.; Dr.-Ing. Aysar Musa; Steffen Vogel, M. Sc., Marco Pau, Ph. D. Ferdinanda Ponci, Ph.D.; Prof. Ferdinanda Ponci is currently a professor for "Monitoring and distributed control for power systems" at the Institute for Automation of Complex Power Systems at RWTH Aachen University. She is currently engaged in research on automation and advanced monitoring of active distribution systems. Among others, she has participated in various EU projects leading technical activities on behalf of RWTH, including FP7 IDE4L, H2020 ADMS, and SOGNO. Univ.-Prof. Antonello Monti, Ph.D.; Prof. Antonello Monti is the director of the Institute for Automation of Complex Power Systems at RWTH Aachen University. He coordinates a research group of about 40 scientists focusing on Power Systems Dynamics, Grid Automation and ICT for Energy. Prof. Monti's group has been involved in several FP7 and H2020 projects. He has been Coordinator of the EU FP7 project COOPERaTE and Technical Manager of the EU FP7 project FINESCE. He is also a coordinator of the H2020 ADMS and ERA-NET FISMEP. Gianluca Lipari, Ph. D. Gianluca Lipari is a Postdoctoral Research Associate at the Institute for Automation of Complex Power Systems at RWTH Aachen University. At the institute, he is leading the research team for Energy Flexibility Management and Optimization. His research work includes the coordination of RESs and BESSs in grid application, distribution grid modeling and simulation, measurement techniques, and the development of Phasor Measurement Units development testing and application. David Raisz Ph. D.; David Raisz is a Postdoctoral Research Associate at the Institute for Automation of Complex Power Systems at RWTH Aachen University. His current research work focuses on the concept of Linear Swing Dynamics and Virtual Oscillator Control of inverters

	Sriram Karthik Gurumurthy, M. Sc.; Sriram Karthik Gurumurthy is a Research Associate at the Institute for Automation of Complex Power Systems at RWTH Aachen University. His research focuses on impedance measurement concepts, harmonic stability monitoring and virtual output impedance control for power electronic driven power grids Dr.-Ing. Aysar Musa; Dr.-Ing. Aysar Musa worked as Research Associate at the Institute for Automation of Complex Power Systems at RWTH Aachen University. He was involved in the team Power System Control. He recently successfully defended his dissertation, entitled "Advanced Control Strategies for Stability Enhancement of Future Hybrid AC/DC Networks". Steffen Vogel, M. Sc., Steffen Vogel is a Research Associate at the Institute for Automation of Complex Power Systems at RWTH Aachen University. His research focuses on Real-time System Programming, and the analysis and routing of Complex Computer Network Marco Pau, Ph. D. Marco Pau is a Postdoctoral Research Associate at the Institute for Automation of Complex Power Systems at RWTH Aachen University. At the institute, he is leading the research team for Distribution Grid Monitoring and Automation. His research work includes State Estimation, Measurement techniques, the Uncertainty propagation theory, Phasor Measurement Units, and synchrophasor algorithms.
OTHER DETAILS	
Envisioned starting date	06 April 2020
MOOC background	The MOOC was delivered face-to-face for the first time for the H2020 RESERVE project.
Target MOOC audience	PhD Students, Masters Students
Participant's requirements/ prior knowledge needed.	Power System Analysis and Control
License (CC/ all rights protected)	CC

Special technical requirements	no
CONTACT PERSON	
Name	Ferdinanda Ponci, Ph. D.
email address	fponci@eonerc.rwth-aachen.de

Table 7: Programme Proposal: Challenges and solutions in Future Power Networks

GENERAL INFO	
MOOC Title	**Innovation and Diversity in engineering**
Providing Institution	**RWTH Aachen University**
Description	Engineers design solutions with and for people – people who come from a wide variety of cultural backgrounds, with many different and intersectional identities based on gender, ethnicity, race, religion, sexual orientation, socioeconomic background, and more. And they increasingly work within interdisciplinary teams and across cultures to develop, adapt, and deploy technologies that consider the societal challenges of tomorrow. If they have not had learning experiences that focus on dimensions of human diversity, however, engineers are more likely to fall back on stereotypes and personal frames of reference that can limit the scope and quality of their work. Given changing demographics among engineers and engineering students and increasing awareness of the ways in which bias may impinge on engineering problem-solving to reach optimal solutions a course providing an opportunity to learn about culture and diversity can benefit engineers' training. In 2015, the inaugural Expanding Engineering Limits course was offered to undergraduate and graduate engineering students simultaneously as a transnational course between an American and a German university (Stanford University in the United States and RWTH Aachen University in Germany. The course analyses the interrelations between engineering, social practice and (its) culture in the context of gender and diversity. It provides new perspectives and reflects the complex impact of social aspects for our everyday learning and working in research, development and engineering practice. The course gives an introduction to selected literature and gives engineering students basic but also further knowledge in terms of gender and diversity approaches, social practice, and engineering culture. Students gain insights about a variety of related questions and topics on “How does culture shape and impact engineering?”. We set a particular focus on

	cultural aspects of gender and diversity which have a considerable impact and select, who becomes an engineer, which kind of tasks are selected to work on, as well as the way and the quality of developed solutions, designs, technologies, and products. As the course wants to integrate its participants, we will not only have text but also group works and discussions to exchange different views. Building on this course a MOOC will be developed to enhance students' understanding of diversity among people with whom they work in the technology-based enterprise, and for whom they design products and services. The MOOC will be realized in the frame of the "Medienzentrum für Lehre" a cross-faculty service unit of the RWTH Aachen University.
Duration in Weeks	8 weeks
Total participant workload in hours	4 hours per week
Course format	Video lectures (pre-recorded videos), text work, group discussions, group work, role play
Primary Language of Delivery	English
Teacher's short bio	Teacher: Prof. Dr. Carmen Leicht-Scholten Carmen Leicht-Scholten (F) is a Professor and head of the research group "Gender and Diversity in Engineering" at the Faculty of Civil Engineering at RWTH Aachen University and rector's delegate for socially responsible education. From 2012-2016 she has been Vice Dean for Studies affairs at the faculty. Together with her interdisciplinary team of engineers, natural scientists, and social scientists, she as a political scientist is working on the inclusion of diversity in research and development processes and at different levels of organization development. Her fields of research focus on realizing sustainable and socially responsible research by integrating gender and diversity perspectives in science and technology research and innovation processes. As an expert for gender and diversity studies, Prof. Leicht-Scholten has been a member in national and international advisory boards In 2014, Prof. Leicht-Scholten has been invited to Stanford University as a visiting professor. The development of the transnational course "Expanding Engineering Limits: Culture, Diversity, and Gender" together with colleagues from the School

	of Engineering at Stanford University has been initiated at that time. Julia Berg, M.Sc Julia Berg is a research assistant of the research group "Gender and Diversity in Engineering" at the Faculty of Civil Engineering at RWTH Aachen University. and Diversity in Engineering" at the Faculty of Civil Engineering at RWTH Aachen University.
OTHER DETAILS	
Envisioned starting date	October 2020
MOOC background	Similar courses offered: Diversity and Innovations: seminar using interactive blended learning concepts for students at the RWTH Aachen Expanding Engineering Limits: Culture, Diversity, and Gender: collaboration between the GDI of RWTH Aachen University and the School of Engineering of Stanford University, CA, USA; comprises three single courses
Target MOOC audience	Engineering students
Participants requirements	Readiness to read papers from other disciplines, readiness to work in interdisciplinary and international teams
License	CC
Special technical requirements	no
CONTACT PERSON	
Name	Julia Berg
email address	julia.berg@gdi.rwth-aachen.de

Table 8: Programme Proposal: Innovation and Diversity in engineering

GENERAL INFO	
MOOC Title	**Renewable Energy Technologies**
Providing Institution	**This programme will be developed as part of the curricula of the Department of Industrial Engineering of the University of Naples Federico II**
Description	Renewable energy sources play a key role in the transition toward a zero-carbon society: by 2050, they are expected to supply more than 2/3 of the global energy demand, strongly contributing to reducing greenhouse gas emissions and limiting the effects of global warming. The MOOC offers an up-dated and comprehensive overview of renewable energy technologies, from technical and economic perspectives.
Duration in Weeks	8 weeks
Total participant workload in hours	Max 6 hours per week.
Course format	Main tools for communication Main tools for the study
Primary Language of Delivery	English
Preferred language(s) to be included as a translation and transcription option	English
Teacher's short bio	Massimiliano Dentice D'Accadia is the Energy Manager of University of Naples Federico II and member of the Advisory Board of the Department of Industrial Engineering. His fields of interest cover are the thermodynamic and thermo-economic analysis of Advanced Energy Systems; energy saving in industry and buildings; renewable energy sources (solar energy, geothermal energy, biomass and waste).

	Francesco Calise is Professor of industrial technical physics at the University of Naples Federico II. His research activity has been mainly focused on the following topics: fuel cells, advanced optimization techniques, solar thermal systems, concentrating photovoltaic/thermal photovoltaic systems, energy saving in buildings, solar heating and cooling, Organic Rankine Cycles, geothermal energy, dynamic simulations of energy systems, renewable Polygeneration systems and many others. Maria Vicidomini is a researcher at the University of Naples Federico II. Her research activity has been mainly focused on the development of dynamic simulation models for the energy, exergy, economic and environmental analysis and impact of innovative systems for distributed polygeneration systems, supplied by renewable energy (geothermal, solar, wind energy) and natural gas. Building Integrated Solar Thermal Systems and internal combustion engines for the production of heat, cool and power. Solar heating and cooling systems. Solar desalination systems. The hybrid renewable system based on wind, solar and geothermal energy. Electrical storage. Electric vehicles.
OTHER DETAILS	
Envisioned starting date	April 2020
Target MOOC audience	Students in engineering
Participants requirements	No
License	CC
Special technical requirements	no
CONTACT PERSON	
Name	Massimiliano Dentice D'Accadia
email address	dentice@unina.it

Table 9: Programme Proposal: Renewable Energy Technologies

GENERAL INFO	
MOOC Title	**Electric heat pumps in the energy transition framework**
Providing Institution	**This program will be developed as part of the curricula of the Department of Industrial Engineering of the University of Naples Federico II.**
Description	The MOOC aims to give an overview of the heat pump technologies application in the context of the energy transition. In particular, using a case-based approach, the course will start with examples of the heating and cooling needs of the buildings then moving to the working principle and technologies of the electrically driven heat pumps. After examples of energy performance indicators calculations and dynamic simulation of the heat pump coupled to a building, the integration of the heat pumps into more complex systems (smart grids) is discussed, introducing the tools allowing heat storage and strategies for control (demand side management). Course structure 1. Electric heat pumps: the potential role in a scenario of large energy production by renewable sources 2. Heating and Cooling needs in nZeb building 2.1. introduction to the user types 2.1.1. building categories 2.1.2. heating and cooling loads calculation methods 2.2. climate zones definitions according to EU regulations 2.2.1. typical winter load profile 2.2.2. typical summer load profile 2.3. A load profile for a case study 3. Primary energy consumption and environmental impact 3.1. primary energy consumption and environmental impact basic calculations 3.2. comparison with a burner during the heating season 4. How does a heat pump work? Which factors do affect a heat pump operation? 4.1. Working principle for vapor compression systems and technical limits for operation 4.2. Experimental data of performance under steady-state (lab) and variable (real) conditions 5. Recent technologies for heat pumps

	5.1. High performance chiller systems 5.2. Multiple unit direct expansion systems 5.3. Systems working with natural fluids 6. Estimation of seasonal performance indicators 6.1. Standards 6.2. Example of calculation based on a case study 7. Heat pump coupling to a building: a case study 7.1. Sizing of the system 7.2. Description of the maps of performance and example of dynamic simulation of a heat pump 8. System Integration: thermal energy storage and district operation 8.1. Basics of thermal energy storage technologies for heat carriers at low and medium temperatures 8.2. Effect of heat storage application at a district scale 9. Heat pumps in complex systems 9.1. Heat pump integration in smart grids 9.2. Demand side management Learning objectives Once students have completed the course, they will be able to: • know the potential use of a heat pump in the energy transition framework • describe heating and cooling load profile • do simple calculations of primary energy consumption and environmental impact • describe the heat pump working principle and understand the variation of the performance under variable boundary conditions • know the basics of different technologies • Estimate the performance of a heat pump according to standards • Size a heat pump and read critically the results of a dynamic simulation • describe the technologies for heat storage with heat pumps • know some examples of application in complex systems
Duration in Weeks	9 weeks
Total participant workload in hours	Max 6 hours per week.

Course format	Main tools for communication Conversation section at the bottom of each page, where you can post comments and reply to others. Blogs, available within the EMMA platform, provides a space to document your learning. Main tools for the study This MOOC makes use of a range of technologies to enhance learning, including podcasts, videos, and presentations.
Primary Language of Delivery	English
Preferred language(s) to be included as a translation and transcription option	English
Teacher's short bio	**Nicola Bianco** is a Full Professor of Heat transfer and Applied Thermodynamics at the Federico II University of Naples (Italy). He has experience in teaching, R&D and technology transfer activities in the field of energy conversion systems. **Alfonso William Mauro** is an Associate Professor of Refrigeration and Applied Thermodynamics at the Federico II University of Naples (Italy). He has experience in teaching, R&D and technology transfer activities in the field of energy conversion systems. **Fabrizio Ascione** is an Associate Professor of Applied Thermodynamics and Heat transfer for buildings at the Federico II University of Naples (Italy). He has experience in teaching and scientific research in the field of efficient energy systems for the built environment. **Luca Viscito** is a Research Fellow at the Department of Industrial Engineering, Federico II University of Naples (Italy). He has experience in scientific research in the field of energy conversion systems.
OTHER DETAILS	
Envisioned starting date	April 2020
Accreditation possibilities	Completion certificates are available to anyone completing 80% of the course. These certificates are not credit bearing. You will receive your certificate directly via email a couple of weeks after the end of the course.

MOOC background	At the best of the knowledge of the teachers, there is not a similar course offered neither as a MOOC or as a face-to-face course. Contents of some lessons are presented, in Italian, at the Polytechnic School of the Federico II University –as a face-to-face course of the master degree in mechanical engineering for energy and the environment, and at other Universities (both in Italy and in other countries)
Target MOOC audience	Students in engineering
Participants requirements	A bachelor's degree in engineering with a minimum of 8 ECTs in engineering thermodynamics is a prerequisite.
License	The course materials are available under the Creative Commons License CCBY-NC-SA (http://creativecommons.org/licenses/by-nc-sa/4.0/) unless stated otherwise.
CONTACT PERSON	
Name	Nicola Bianco
email address	nicola.bianco@unina.it

Table 10: Programme Proposal: Electric heat pumps in the energy transition framework

GENERAL INFO	
MOOC Title	**Green professionalization and ethics**
Providing Institution	**This program will be developed by the UNINA Dept. of Social Sciences and be offered to both employed people and students of various departments.**
Description	The green transition is changing the world of professions and occupations. New jobs emerge, other seems to be transformed. In both cases, the sustainability value is embodied in the skill profiles. These "green collars" connect research, industry, and consumers in order to foster new social practices (i.e., e-mobility). At the same time, they have to conciliate the institutionalization of the energy transition "discourse" with the local needs of the territories (i.e., green energy facilities). They need to acquire innovative technical skills and social ones as well, in order to accomplish their role in promoting a fair and sustainable transition. The course shows how the analytical dimension of professionalism (education, expertise, social legitimation, ethics, etc.) are at stake within the field of the energy transition.

	Some empirical cases of green professionalization (i.e., the wind farm developers) will be reported and discussed. This course aimed at building capacity for evaluations, investigations, and design of green-collars for sustainable transition considering socio-technical skills and ethical dimensions. Learning Objectives and Outcome Participants will be able to understand how the professional profiles of the energy transition are intertwined with the overall process of social-technical change. Emerging compromises between technical and social skills will be detected and analyzed. Furthermore, participants will be able to establish connections between the green professionalization process and the user domain, in order to understand how to enhance new paths of sustainable energy consumption. Course Structure Lesson 1: Profession in transition Unit 1 Key concepts in the sociology of professions Unit 2 Professions dealing with energy transition. Unit 3 Readings, recap, and assessment Lesson 2: Experts and society in transition. Unit 1 Experts and risk society Unit 2 Experts and environmental controversies Unit 3 Readings, recap, and assessment Lesson 3 Green-collars and professionalization process Unit 1 Green sector and new socio-technical skills demand Unit 2 Wind-farm developer: an example of “green-collar” Unit 3 Readings, recap and assessment
Duration in Weeks	6
Total participant workload in hours	2 hours per week

Course format	Pre-recorded videos will be used for the course and some materials (e.g. scientific articles) will be proposed to deepen the topics covered.
Primary Language of Delivery	English
Preferred language	English
Teacher's short bio	Dario Minervini is researcher at the University of Naples, Dept. of Social Sciences. He teaches Environmental Sociology. His main research interests include the socio-material construction of sustainability, professionalism and gender studies. On these themes, he published articles and books.
Envisioned starting date	March 2020
OTHER DETAILS	
Accreditation possibilities	Completion certificates are available to anyone completing 80% of this course. These certificates are not credit bearing. Participants will receive the certificate directly via email after the end of the course.
Target MOOC audience	The course is addressed to students, professionals and company staff in training.
Participants requirements	No
License	The course materials are available under the Creative Commons license CC BY-NC-SA http://creativecommons.org/licenses/by-nc-sa/4.0/ , unless stated otherwise.
Special technical requirements	No
CONTACT PERSON	
Name	Dario Minervini
email address	dario.minervini@unina.it

Table 11: Programme Proposal: Green professionalization and ethics

GENERAL INFO	
MOOC Title	**Corporate Communication and Corporate Social Responsibility**
Providing Institution	**This program will be developed by the UNINA Dept. of Social Sciences and be offered to both employed people and students of various departments.**
Description	Social and environmental responsibility has become a common issue in corporate communication, but how to design an efficient communication plant? Why did the subject of 'responsibility' become a relevant topic? Which role is playing ICT in corporate communication? Are they suitable for the communication of corporate social responsibility? This course offers insight on corporate social responsibility and communication reporting the connections among organizational models, communicational functions, consumption trends, new communication technologies, and socio-environmental crises. The course will show examples of the communication of energy companies and how they face the socio-environmental responsibility in marketing communication and public relations. This course aims at building capacity for evaluations, investigations, and design of communication plan focusing on socio-environmental issues. Learning Objectives and Outcome At the end of the course, participants will be able to understand the corporate communication strategy related to the socio-environment issues. Participants will also be able to prepare a short communication plan, which is the final course exercise. Course Structure Lesson 1: Profession in transition Unit 1 Key concepts in sociology of professions Unit 2 Professions dealing with energy transition. Unit 3 Readings, recap and assessment Lesson 2: Experts and society in transition. Unit 1 Experts and risk society Unit 2 Experts and environmental controversies

	Unit 3 Readings, recap and assessment Lesson 3 Green-collars and professionalization process Unit 1 Green sector and new socio-technical skills demand Unit 2 Wind-farm developer: an example of “green-collar” Unit 3 Readings, recap and assessment
Duration in Weeks	6 weeks
Course format	Pre-recorded videos will be used for the course, and some materials (e.g. scientific articles) will be proposed to deepen the topics covered.
Primary Language of Delivery	English
Preferred language(s) to be included as a translation and transcription option	English
Teacher’s short bio	Ivano Scotti is a research fellow at the University of Pisa. He has experience as a teacher at the University of Naples (in Corporate Communication) and the Fondazione Campus of Lucca (Sociology of Sustainable Tourism). His main research interests include energy and environmental issues as well as related dimensions (like green jobs and ecological communication). More details: https://www.researchgate.net/profile/Ivano_Scotti
OTHER DETAILS	
Envisioned starting date	March 2020
Accreditation possibilities	Completion certificates are available to anyone completing 75% of this course, and that presents a short communication plan. These certificates are not credit-bearing. Participants will receive your certificate directly via email a couple of weeks after the presentation of the communication plan.

Target MOOC audience	The course is addressed to students, professionals and employees in training or refresher activities.
Participants requirements	No, the course is designed to offer essential insight on the topic.
License	The course materials are available under the Creative Commons license CC BY-NC-SA http://creativecommons.org/licenses/by-nc-sa/4.0/ unless stated otherwise.
Special technical requirements	No
CONTACT PERSON	
Name	Ivano Scotti
email address	ivano.scotti@sp.unipi.it

Table 12: Programme Proposal: Corporate Communication and Corporate Social Responsibility

GENERAL INFO	
MOOC Title	**A holistic approach for Energy Transition: territory, networks, and sustainability**
Providing Institution	**This programme will be developed by the UNINA Dept. of Social Sciences and be offered to both employed people and students from various departments.**
½Description	This course focuses on the socio-territorial and environmental perspectives in order to understand ET as the social construction process. We will address the concepts of sustainability and of participatory planning and their implications in terms of cooperation/conflict. Social Network Analysis will be used to identify networks as a tool of participatory planning; the central actors in the social construction of the ET. This course, promoting a holistic approach, is aimed to reach all individuals interested in the topic and willing to promote sustainable participatory planning of ET.

	DOMAIN: Sustainable Participatory Planning of Energy Transition PEDAGOGY: Each lesson will be articulated as follows: · Slides · Case studies · Readings list · Conversation and blog tools · Multi – choice test based Evaluation LEARNING OUTCOMES/OBJECTIVES: Understand the social construction of Energy Transition in order to: 1 – territorial perspective; 2- social perspective; 3 - environmental perspective Understand the concept of sustainability and of participatory planning. Understand the implications in terms of cooperation/conflict using case studies. Acquire basic notions of theoretical and methodological approach of the Social Network Analysis, specifically in order to identify: - network as a tool for participatory planning; - Role, skills and weight of the brokers LESSONS OUTLINE 1st week – Introduction to Energy Transition • What is Energy Transition? • Energy and social change • Social acceptability of the renewable energies 2nd week - The social construction of Energy Transition • Nimby Syndrome: renewable energy and risk perception • Energy and cultural practices • Renewable energy, environmental justice and local development 3rd week – Meaning and implication of Sustainable planning of Energy Transition • the concept of sustainability • tools of participatory planning • case studies 4th week - Cooperation/conflict: implications

	• Energy communities • Conflicts about the renewable energy. Italian case 5th week - Social Network Analysis as a tool of Participatory Planning • Basic notions of theoretical and methodological approach of the Social Network Analysis • Network as a tool of participatory planning. Case studies 6th week – Governance networks: actors, skills and dynamics • Multilevel Governance • Role, skills and weight of the brokers • Network as resource
Duration in Weeks	6 weeks
Total participant workload in hours	max 4 hours per week
Course format	Each module has a set of lecture slides and suggested readings (book chapters, research papers, scientific essays.). Some modules have presentation of case studies and application of Social network analysis. In some modules, we could invite experts in the field. The understanding of the modules will be evaluated through multi-choices test.
Primary Language of Delivery	English
Preferred language(s) to be included as a translation and transcription	English
Teacher' bios short bio	Prof. Anna Maria Zaccaria Anna Maria Zaccaria is Associate professor of Sociology of Territory and of the Environment at the Department of Social Sciences of the University of Naples "Federico II". Her research interests focus on urban policies, environmental and anthropic risk governance, disaster resilience, urban innovation. She has been the coordinator of different research projects focused on territorial policies. She has published volumes and numerous peer reviewed articles on urban development issues, environmental catastrophes, migratory dynamics, the relationship between territory and organized crime. She is skilled in the use of

	Social Network Analysis and qualitative research methods. She is a member of LIRMAC (Interdisciplinary Research Lab on Mafia and Corruption)- Università Napoli Federico II. She's a member of the Advisory Committee for Project NENEVA on monitoring gas emissions at the Campi Flegrei volcano (Naples), directed by Prof. Stephen Hailes, Department of Computer Science, University College London. She is a member of international long-term projects NERC (directed by prof. Christofer Kilburn, University College of London), within which she studies public attitudes to volcanic unrest. She is member of the board of Regional Park of Partenio (Campania region) and she represents the University of Naples Federico II in the Network of the Universities for Sustainable development (RUS) Prof. Fabio Corbisiero Fabio Corbisiero is an Associate Professor at the Department of Social Sciences of the University of Naples Federico II. He is the scientific director of the LGBT Observatory and of "Osservatorio Universitario sul Turismo". He coordinates research groups on the themes of tourism, urban sociology, gender and Social Network Analysis, environment and anthropic impact, renewable energies. Between 2008 and 2010 he was a Visiting Fellow at CUNY University in New York, before becoming a researcher in 2010. He is the author of several monographs and hundreds of articles. He is the Director of "Fuori Luogo. Journal of Sociology of the Territory, Tourism, Technology ". Dott.ssa Ilaria Marotta Ilaria Marotta is a Ph.D. in Social Sciences and Statistics. She is currently a research fellow at the Department of Social Sciences of the Federico II University in Naples. Her research interests include the sociology of the environment and the territory, with particular reference to questions relating to protected natural areas. For some years she studied the tourist use of the Vesuvius National Park. She is also specialized in the theoretical methodological approach of Social Network Analysis (SNA).
OTHER DETAILS	
Envisioned starting date	March 2020
MOOC background	none
Target MOOC audience	This course is targeted for: • trainers, students, graduates, Ph.D. students and Ph.D. from Social science and from others discipline interested in Energy Transition dynamics; • public administrators, decision makers, and Third sector exponents;

	• all other individuals interested in the topic and willing to promote a participatory plan for sustainable ET.
Participants requirements	Basic knowledge (undergraduate level) in social science and in participatory planning
License	CC
Special technical requirements	No
CONTACT PERSON	
Name	Anna Maria Zaccaria
email address	zaccaria@unina.it

Table 13: Programme Proposal: A holistic approach for Energy Transition: territory, networks, and sustainability

GENERAL INFO	
MOOC Title	**Hydrogen as Energy Vector**
Providing Institution	**Universitat Politècnica de València (Spain)**
Description	The course provides the fundaments of hydrogen technology, using it as a way to store energy. Hydrogen production methods (using different energy sources) are presented, but more special attention is paid to electrolysis as a means for producing hydrogen from renewable energies. Hydrogen storage methods are described and it is explained the process of electrical energy generation from hydrogen by using fuel cell technology. LEARNING OUTCOMES/OBJECTIVES · Understanding industrial electrolysis processes · Capacity of sizing an electrolyzer · Capacity of sizing the storage system · Understanding electricity generation through the use of fuel cells · Ability to select and size a fuel cell.

	LESSONS OUTLINE 1st week – Hydrogen properties and hydrogen production methods · Introduction to the hydrogen economy · Hydrogen properties, applications, and challenges · Hydrogen from natural gas, carbon, petroleum, alcohol. · Hydrogen from biomass, biophotolysis, fermentation. · Hydrogen from thermolysis. · Hydrogen from alcohools. 2nd week – Electrolysis Technology · Alkaline electrolysis technology · PEM electrolysis technology 3rd week – Hydrogen storage technology · Liquid hydrogen storage. · Metal hydrides storage. · Gaseous hydrogen storage. · Demonstration of an alkaline electrolyzer working in the LabDER laboratory 4th week – Fuel Cell Technology and applications · Low temperature fuel cells. · Medium and High temperature fuel cells. · Stationary applications of fuel cells. · Fuel cell mobile applications. 5th week – Fuel cell voltage generation and elements of a PEM fuel cell. · Open circuit voltage generation in the electrochemical reaction. · Irreversibilities in fuel cell voltage generation. · Polymer Membrane Electrolyte fuel cell operating. · Demonstration of a PEM fuel cell working in the Balance of the plant. 6th week - Hydrogen energy storage dimensioning. · Dimensioning the hydrogen production system. · Dimensioning the fuel cell and power electronics.
Duration in Weeks	6 weeks

Course format	Pre-recorded videos, presentations.
Primary Language of Delivery	English
Preferred language(s) to be included as a translation and transcription option	Spanish, French, Italian
Teachers + short bio	*Carlos Sánchez:* Electronics Engineer, Ph.D. (Industrial Engineering). He has participated in 18 research projects funding by the European Commission, Spanish National Ministry, and regional institutions and 8 research projects funding by private companies. He is author of 20 papers in JCR journals and 29 communications to International Conferences. Research activity is developed in the University Institute for Energy Engineering Research from de Universitat Politècnica de València (UPV). He teaches Power Electronics, Solar Photovoltaic Systems, and Hydrogen as Energy Vector in different schools of the UPV. *Elisa Peñalvo:* She received her Ph.D. at the Universitat Politècnica de València in Industrial Engineering. She has 15 years of experience in National and International Research Projects. Along these years, she has closely collaborated with Universities, Research Centers and Industry in numerous R&D projects. Collaborations include Brunel University in London, Iberdrola, RWE Electricity, Gaz De France, RWE, Tractebel, Siemens, and Unión Fenosa. Her research area includes Energy Efficiency in Buildings, Integration of Renewable Energies, Consumers Demand Response and Energy Planning. Furthermore, she has carried out several research fellowships at international research centers, such as University Tor Vergata in Rome or Lawrence Berkeley National Laboratory in San Francisco. She teaches Renewable Energies, Energy Markets, and Electrical Engineering.
OTHER DETAILS	
Envisioned starting date	April 2020
MOOC background	The course is based on a face-to face scheme offered in the Master's program of Energy Engineering Technology from the Universitat Politècnica de València.

Target MOOC audience	University students, technical professionals
Participants requirements	Basic knowledge of thermodynamics, electrochemistry, and electronics. Basic knowledge of Matlab/Simulink.
License	CC
Special technical requirements	no
CONTACT PERSON	
Name	Carlos Sánchez Díaz
email address	csanched@eln.upv.es

Table 14: Programme Proposal: Hydrogen as Energy Vector

GENERAL INFO	
MOOC Title	**TRAIN THE TRAINER**
Providing Institution	**OTEAcademy**
Description	"Train the Trainer" stands for a session, which is addressed to trainers who are willing to offer training in adults. It has a pedagogical background and participants will learn how to teach adults in a more effective way. The main purpose of the course is to improve the trainers' capabilities to engage their audience. More specifically, by the end of the course, participants will be able to discover how adults learn and what motivates adult learners, to design training sessions, prepare and deliver training sessions, practice proven training techniques, develop effective communication, manage and engage different audiences, improve standards of teaching and training by means of reflective practice. SUMMARY SYLLABUS ● General Principles of Adult Education ● Scope of Adult Training ● Training Aims & Objectives ● 4 Phases of Adult Training ● Training Structure

	• Training Execution • Audience Communication • Audience Management
Duration in Weeks	6
Total participant workload in hours	max 4 hours per week
Course format	PPT and quizzes
Primary Language of Delivery	English
Preferred language(s) to be included as a translation and transcription option	English
Teacher's short bio	Nikos Agiotis- Stavroula Bertzouani-Marios Vlachos ICT Training and Certifications Manager Nikos holds a Bachelor of Business Administration with major upon Computer Information Systems from City University of New York-Baruch College. His previous working experience was upon network engineering and IT department supervision. The last 10 years as a Certified Trainer for Adults works at OTEAcademy as an Alcatel-Lucent instructor, Cisco academy instructor. Seminars delivered by Nikos include Leadership, OmniPCX Enterprise, OmniSwitch, IT Essentials, CCNA, CCNP, CCSP, TCP/IP network design, intrusion prevention sensors, advanced routing protocols, advanced switching, secure virtual private networks, wireless networks, securing network devices, interconnecting secure wide area converged networks, optimizing networks, building remote access networks. Stavroula Bertzouani Learning Development & Content Manager & Professional Trainer, Stavroula studied Business Administration and Finance at the American College of Greece and she has also MSc in Finance. She began her career in Sales and Customer Experience in well-known companies of retail, education, and banking. At OTEAcademy had the opportunity to become an expert in Customer Experience. The magic combination of her

	organizational skills and her love for education led her to train a large number of business staff and managers. Additionally, she is in charge of training design, implementation, and evaluation and she is the product manager of Love2Learn programmes. She is also certified as a Trainer for Adults. Marios Vlachos Senior Training consultant / trainer / coach Manos Vlasis studied Economics at the University of Piraeus and has an MSc in Marketing and Communication at the Athens University of Economics and Business. He owned a managerial role in the sales & marketing departments in many companies such as Nestle Hellas, Sony Hellas, Centric Multimedia, CD Media. In the last 6 years he became an expert in Customer Experience, he is a CCXP and he is a Master Practitioner by the Academy of Service Excellence (UK). His passion for lifelong learning led him to be certified as Leadership Trainer by Coverdale and currently as a senior trainer undertakes the educational training of leadership skills in the highest levels of management at OTE Group.
OTHER DETAILS	
Envisioned starting date	15/5/2020
Accreditation possibilities	NO
MOOC background	Customer Experience
Target MOOC audience	TRAINERS & TEACHERS
Participants' requirements	NO
License	CC/Creative Commons
Special technical requirements	no
CONTACT PERSON	
Name	OTEAcademy

email address	info@oteacademy.gr

Table 15: Programme Proposal: Train the trainer

GENERAL INFO	
MOOC title	**New Materials for solar cells applications**
Providing Institution	**University of West Attica**
Description	The objective of this course is to provide an insight into the fundamentals of solar cells and describe the manufacturing processes of different types of photovoltaics (PV). Throughout the course, students will learn the physical principles of solar irradiation and solar cell operation. Emerging concepts of polymer, hybrid and quantum-dot-based solar cells will be described including device physics, manufacturing and technological development. **Learning Objectives:** · Introduction in new materials for solar cells applications · Solar Energy · Solar Cell Technology · Production of solar cells · Types of solar cells · Material characterization · Optical measurements · Materials properties and characterization · Solar Energy Spectrum and Band Gap Tuning · Case studies **Learning Outcomes:** · Recall the history of Solar Cells · Identify the importance of Solar Energy · Define the Power generation from solar cells · Describe Solar cells technology · Recall the operation of solar cells · Describe the Production of solar cells · List thin films solar cells · Describe the polymer solar cells · Define Methodology and Importance of materials characterization · List the Characterization techniques · Describe the optical measurements · Identify materials properties and characterization · Define implement Solar Energy Spectrum and the Necessity of Band Gap Tuning

	· Recognize the relationship between the profession of Industrial Design and Production Engineering and the renewable resources of energy and their interdependence. · Ability to apply that knowledge in his/her business life.
Duration in Weeks	8 weeks
Total participant workload in hours	4 hours per week
Course format	Slides, pre-recorded videos, presentations, exercises-tests
Primary Language of Delivery	English
Preferred language(s) to be included as a translation and transcription option	Greek
Teachers short bio	Dr. Theodore Ganetsos – Professor Bachelor in Physics and Ph.D. in Material Science (2001) in Germany, over 90 papers in Sci. Journals and 120 participations in International Conferences. Expert in material characterisation using non-destructive techniques. In the last 2 years 4 papers in Journals related to the material for solar cell applications. Dr. Kyriaki Kiskira – Postdoc Scientist Postdoctoral researcher at the School of Chemical Engineering (NTUA, Greece) and a teaching associate at the Department of Industrial Design and Production Engineering, Faculty of Engineering (UNIWA, Greece). Ph.D. in Environmental Technologies from UNICAS (Italy), UNESCO-IHE (Netherlands) and Paris-Est (France). Experienced Researcher with a demonstrated history of working in the research, in the field of Environmental Technologies, Mining Engineering, Metals and Minerals, Environment, Characterization of Minerals, Material Science and Renewable energy sources.
Other Details	
Envisioned starting date	23/3/2020

MOOC background	Background for the course: - Semiconductor Physics, Electronics - Face to face and online - Special MOOC platform - Planned future face-to-face and online activities
Participants requirements/ prior knowledge needed?	no
License	CC
Special technical requirements	No
CONTACT PERSON	
Name	Dr. Theodore Ganetsos - Professor
email address	ganetsos@uniwa.gr

Table 16: Programme Proposal: New material for solar cells applications

GENERAL INFO	
Name of MOOC	**Energy and Environment**
Providing Institution	**This program will be developed and be part of the curricula of the undergraduate program of the Department of Electrical and Electronics Engineering of UWA**
Description	The MOOC aims to give an overview and the knowledge for the interconnection of the production and consumption of energy with the environment under the context of the energy transition. In particular, using a case-based approach, and tools' analysis, the course will start with the basic and core presentation of the impact of energy generation and consumption on the environment in terms of resource consumption, gas emission, impact on land and water. After examples of energy and environmental performance indicators, calculations and presentation of different approaches and case studies, the implementation of energy efficiency and RES in the environment is evaluated. Typical approaches

	involving consumer behavior and product selection are included. Basic aspects related to the evaluation of the environmental impact of products, their end-of-life and basic principles of eco-design are also presented. 1. Energy and environmental policies and their interdependence. 2. Energy generation and environment, greenhouse gas emissions and climate change. 3. Energy efficiency and energy saving: Introduction to energy efficiency in products and systems. 4. The European Directives Eco-label, Energy-label, Eco-design, RoHs, EMAS, and their application to equipment and various industrial devices 5. The life cycle analysis in the production and operation of the equipment 6. End-of-life of waste electrical, electronic and industrial equipment. Legislation 7. Designing systems in accordance with the instructions for EcoDesign. Learning objectives Once students have completed the course, they will be able to: ● Relate the energy generation and consumption with the environment. ● Recognize the impact on the local and global climate that the energy generation and consumption have. ● Classify what is Renewable and non-renewable source of energy. ● Describe the energy efficiency, ecolabel EU legislation ● Select energy efficiency and energy savings actions in everyday life and especially in energy consumption, at the appliance level, house level, enterprise level, country level. ● Identify and select equipment and devices based on the energy efficiency criterion. Ability to perform the studies and work and to assess their results considering this parameter. ● Ability to use the principles of ecological design (Eco-Design) and environmental legislation regulations that define the design, operation, and end of the life cycle of electrical equipment and installations, in his/her professional activity.

	• Describe the legislation on the end of life treatment and recycling potential of waste electrotechnical equipment, as a key activity related to energy consumption and environment • Recognize the relationship between the profession of Electrical Engineering and the environment and their interdependence. • Ability to apply that knowledge in his/her business life.
Duration in Weeks	10 weeks
Total participant workload in hours	max 3 hours per week
Course format	Presentations, Pre-recorded videos, discussions, case studies, exercises.
Primary Language of Delivery	English
Preferred language(s) to be included as a translation and transcription option	English/ Greek
Teacher's short bio	Professor Constantinos S. Psomopoulos is the Director of the High Voltage and Energy Systems Research Lab of the School of Engineering of the University of West Attica. He has worked for several years in different industrial sectors (Shipyards industry, Waste Management facilities, Energy facilities, etc), and he is now also an independent consultant. His research interests include energy efficiency and RES, sustainable waste/resources management, EcoDesign of products and systems, and critical energy infrastructure operation and protection. He has participated in many National, International and EU funded projects in these fields. He was the technical manager of the "Study for preparing the first Working Plan of the EcoDesign Directive, ENTR/06/026", Service Contract for EU/DG ENTR". Since 2017 he cooperates as an expert with the ClimateKIC –Malta, he is member of the Stakeholders Consultation Forum (Expert) for the revision of the Ecodesign Regulation EU 548/2014 on Power Transformers, TWG Member for the Development of the EU Green Public Procurement (GPP) Criteria for Data Centres by EU JRC, and evaluator of EURAMET in the fields of Energy, Industry and Prenormative. He was Professor in PUAS from 2007 until March 2018, when he joined the Electrical and Electronics Engineering Department of the University of West Attica. He is a Research Associate in Earth Engineering Center of Columbia University NY since 2011, and he is a Visiting Professor in University d' Auvergne since June 2016.

OTHER DETAILS	
Envisioned starting date	2/4/2020
Accreditation possibilities	Completion certificates are available to anyone completing 80% of the course. These certificates are not credit bearing. You will receive your certificate directly via email a couple of weeks after the end of the course.
MOOC background	Department of Electrical and Electronics Engineering of UWA is offering the course face-to-face in Greek: https://eclass.uniwa.gr/modules/user/index.php?course=EEE240
Target MOOC audience	
Participants requirements/ prior knowledge needed?	Basic Mathematics and basic energy and environmental knowledge
License	CC
Special technical requirements	no
CONTACT PERSON	
Name	Dr. Constantinos S. Psomopoulos – Professor
email address	cpsomop@uniwa.gr

Table 17: Programme Proposal: Energy and Environment

GENERAL INFO	
Name of MOOC	**Energy Efficient and Ecological Design of Products and Equipment**
Providing Institution	**This programme will be developed and be part of the curricula of the MSc Program "Management and**

	Optimization of Energy Systems" of the Department of Electrical and Electronics Engineering of UWA
Description (subject, domain, pedagogy, learning outcomes/objectives, outline of lessons if possible, summary syllabus)	• The MOOC aims to give an overview and the knowledge for the implementation of the eco-design in every product or system design in the context of the energy transition. In particular, using a case based approach, and tools' analysis, the course will start with the basic and core legislation then moving to the economics and working principle and methodologies used for implementing eco-design and energy efficient design. After examples of energy and environmental performance indicators calculations and presentation of different approaches and case studies, the implementation in every potential product or system is presented and discussed, under the context of smart, affordable and sustainable energy context. • Introduction to Energy Efficiency and EcoDesign. The EU Energy Efficiency and EcoDesign Directives. • The Economics of Energy Efficient Design and EcoDesign of products • Consumer Orientation - Innovation through Eco-Design and Energy efficient Design • The development of a strategy for Eco and Energy efficient design - The connection of the energy and environmental aspects of the design process • The Life Cycle Analysis for designers and Total Cost of Ownership for consumers • Analysis of the Concepts and Methodologies. Basic Tools for the Energy efficient and Eco Design of Products. • The role of RES in the ecological design of systems and products • Equipment and Product case studies and examples. • **Seminars and case studies with portable techniques** • **Learning objectives** • Once students have completed the course, they will be able to: • Analyze the EU Energy Efficiency, EcoLabel, EcoDesign, RoHS and WEEE Directives. • Identify the connection of the energy and environmental aspects of the design process of a product and a system, during the total life cycle of a

	product. • Identify the Economics of Energy Efficient Design and EcoDesign of products and systems. • Identify the Consumer Orientation - Innovation through Eco-Design and Energy efficient Design, based on the total life cycle analysis approach. • Combine methods for developing and adopting strategies for Eco and Energy efficient design of products and systems through analysis of all phases in their life and reverse engineering approaches. • Analyze different components and methods for reducing the impact of a product or equipment in the environment during the different phases of its life cycle. • Combine the Concepts and Methodologies and Basic Tools for the Energy efficient and Eco Design of Products. • Ability to perform Life Cycle Analysis and Life Cycle Costing Analysis during the design of a product and the calculation of the Total Cost of Ownership • Intergrade RES during the energy efficient and ecological/sustainable design process or during improvement schemes for systems and products. • Ability to perform the studies and work and to assess their results considering this parameter. • Ability to use the principles and methodologies of energy efficient and ecological/sustainable design (Eco-Design) in his professional activity.
Duration in Weeks	12 weeks
Total participant workload in hours (course + homework)	Max 6 hours per week.
Course format (levels of interaction, text-based syllabus, pre-recorded videos, live webinars, podcasts, presentations, discussions, etc.)	Presentations, Discussions, Case Studies, and Exercises,
Primary Language of Delivery	English
Preferred language(s) to be included as a translation and	Greek

transcription option	
Teachers + short bio	Professor Constantinos S. Psomopoulos is the Director of the High Voltage and Energy Systems Research Lab of the School of Engineering of the University of West Attica. He has worked for several years in different industrial sectors (Shipyards industry, Waste Management facilities, Energy facilities, etc), and he is now also an independent consultant. His research interests include energy efficiency and RES, sustainable waste/resources management, EcoDesign of products and systems, and critical energy infrastructure operation and protection. He has participated in many National, International and EU founded projects in these fields. He was the technical manager of the "Study for preparing the first Working Plan of the EcoDesign Directive, ENTR/06/026", Service Contract for EU/DG ENTR". Since 2017 he cooperates as an expert with the ClimateKIC –Malta, he is member of the Stakeholders Consultation Forum (Expert) for the revision of the Ecodesign Regulation EU 548/2014 on Power Transformers, TWG Member for the Development of the EU Green Public Procurement (GPP) Criteria for Data Centres by EU JRC, and evaluator of EURAMET in the fields of Energy, Industry and Prenormative. He was Professor in PUAS from 2007 until March 2018, when he joint the Electrical and Electronics Engineering Department of University of West Attica. He is Research Associate in Earth Engineering Center of Columbia University NY since 2011, and he is Visiting Professor in University d' Auvergne since June 2016.
OTHER DETAILS	
Envisioned starting date	2/4/2020
Accreditation possibilities	Yes, it can have accreditation. Completion certificates are available to anyone completing 80% of the course. These certificates can be credit bearing. You will receive your certificate directly via email a couple of weeks after the end of the course.
MOOC background, for example: -Example of a (similar) course? Provide URL -Already offered face-to-face or	Background for the course: - Energy and Environment, - Optimization Strategies and Energy Management Systems - Energy Efficiency,

online? (Where? to whom? additional observations) -On another MOOC platform? -Planned future face-to-face and /or online activities?	- Renewables, Already offered face-to-face only in a MSc Program of UWA - Face to face and online - Special MOOC platform - Planned future face-to-face and online activities
Target MOOC audience	Engineers in the fields of Electrical, Mechanical, Energy, Environmental, Chemical, Industrial Engineering
Participants requirements/ prior knowledge needed?	Engineering Degree mainly in the fields of Electrical, Mechanical, Energy, Environmental, Chemical, Industrial Engineering Level of Participants at least 6
License (CC/ all rights protected)	All rights Protected
Special technical requirements	no
CONTACT PERSON	
Name	Dr. Constantinos S. Psomopoulos – Professor
email address	cpsomop@uniwa.gr

Table 18: Programme Proposal: Energy Efficient and Ecological Design of Products and Equipment

2.4.2 Learning material development

This session collects 16 MOOC Syllabus with major details on course structure and content lesson by lesson as for Form C in Annex I. It offers a complete course overview with a higher granularity (lessons/units).

2.4.2.1 Learning Material: Optimization Strategies and Energy Management Systems

Course Title	Optimization Strategies and Energy Management Systems
To be published: 15/10/2020 Closing date: 12/11/2020	Coauthors: Dr. Moisès Graells Dr. Eleonora Riva Sanseverino Najmeh Bazmohammadi
Overview	Energy is a resource that needs to be managed and decisions need to be made on production, storage, distribution and consumption

	of energy. Participants attending this course will learn how to recognise and formulate different optimization problems in operation management, and control of energy systems, and how to solve them using existing software and solvers. Different principal algorithms for the linear, network, discrete, and dynamic optimization are introduced and related methodologies together with underlying mathematical structures are described accordingly. Several illustrative examples will be used for solving several real-world use cases.
Learning Objectives and Outcomes	• Relate process system engineering with the modelling and optimization techniques used in power systems. • Apply different optimization tools for continuous, semi continuous and discrete optimization problems in energy systems and implement them using Excel, MATLAB or GAMS. • Design and implement the schemes of Supply side and demand/load side management including peak shaving and load control/ load shifting programmes.

LESSON 1: Introduction to Process Engineering and Energy Management Concept Process system engineering (PSE)	Date 15/10/2020
Learning Objectives: Relate process system engineering with the modelling and optimization techniques used in power systems.	
UNIT 1 TITLE: Interlink between PSE and energy management systems (EMS)	
UNIT 2 TITLE: Energy Management in Microgrids and smart grids	

PEDAGOGICAL TOOLS
Study materials: Video, Lecture Slides, Research Papers, Magazine Articles, MS/Ph.D. Thesis
Assessment: Multi-choice Question
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 2: Introduction to Energy System Modelling and	Date 22/10/2020

Optimization	
Learning Objectives: Apply different optimization tools for continuous, semi continuous and discrete optimization problems.	
UNIT 1 TITLE: Linear Programming	
UNIT 2 TITLE: Quadratic Programming	
UNIT 3 TITLE: Mixed Integer Linear Programming (MILP)	

PEDAGOGICAL TOOLS
Study materials: Video, Lecture Slides, Research Papers, Magazine Articles, MS/Ph.D. Thesis
Assessment: Multi-choice Question
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 3: – Introduction to efficient modelling systems and optimization tools for EMS	Date: 29/10/2020
Learning Objectives: Solve different optimization problems using Excel, MATLAB or GAMS.	
UNIT 1 TITLE: EXCEL	
UNIT 2 TITLE: MATLAB	
UNIT 3 TITLE: GAMS	

PEDAGOGICAL TOOLS
Study materials: Video, Lecture Slides, Research Papers, Simulation handbook

Assessment: Multi-choice Question, Simulation-based report
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 4: Optimization Applications in Microgrids and Smart Grids	Date 05/11/2020
Learning Objectives: Design and implement the schemes of supply side and demand/load side management including peak shaving and load control/ load shifting programmes.	
UNIT 1 TITLE: Peak shaving	
UNIT 2 TITLE: Generation/Supply Side Management	
UNIT 3 TITLE: Demand/Load Side Management	

2.4.2.2 Learning Material: Power Quality Challenges and Solutions for Microgrids

Course Title	**Power Quality Challenges and Solutions for Microgrids**
To be published: 15/10/2020 Closing date: 12/11/2020	Coauthors: Professor Josep M. Guerrero Alexander Micallef Mehdi Savaghebi
Overview	Microgrids are deemed as one of the main building blocks of the smart grids; since they are able to facilitate the implementation of many smart grid functions. On the other hand, the proliferation of different nonlinear and single-phase loads in electrical systems has resulted in voltage harmonics and unbalance as two common power quality problems. In addition, harmonic resonances can be excited giving rise to a significant increase of the voltage distortion. These phenomena can cause a variety of problems such as protective relays malfunction, overheating of motors and

	transformers and failure of power factor correction capacitors. Therefore, in this course, measurement, compensation, and damping of such power quality problems will be addressed through several basic control methodologies.
Learning Objectives and Outcomes	• Illustrate power quality problems including harmonics, power-frequency deviations, voltage fluctuations, voltage dips, swells, interruptions, and voltage unbalance. • Apply various techniques for power quality improvement in microgrids including active power Injection, reactive power-sharing, harmonic current sharing and voltage regulation via smart loads. • Design virtual impedance loops for load sharing and power quality Improvement

LESSON 1: Introduction to Power Quality Issues in AC Microgrids	Date 15/10/2020
Learning Objectives: Illustrate power quality problems including harmonics, power-frequency deviations, voltage fluctuations, voltage dips, swells, interruptions, and voltage unbalance.	
UNIT 1 TITLE: Harmonics and Power-Frequency Deviations	
UNIT 2 TITLE: Voltage Fluctuations, Voltage Dips, Swells, and Interruptions	
UNIT 3 TITLE: Voltage Unbalance	

PEDAGOGICAL TOOLS
Study materials: Video,Lecture Slides, Research Papers, Magazine Articles, MS/Ph.D. Thesis
Assessment: Multi-choice Question
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 2: Harmonic Compensation and Reactive Power Sharing in Microgrids	Date 22/10/2020
Learning Objectives: Apply various techniques for power quality improvement in microgrids including active power Injection, reactive power-sharing, harmonic current sharing and voltage regulation via smart loads.	
UNIT 1 TITLE: Active Power Injection & Voltage Regulation	
UNIT 2 TITLE: Reactive Power Sharing Problem & Voltage Regulation	
UNIT 3 TITLE: Voltage Regulation via Smart Loads	

PEDAGOGICAL TOOLS
Study materials: Lecture Slides, Research Papers, Simulation handbook
Assessment: Video, Multi-choice Question, Simulation-based report
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 3: Virtual Impedances for Power Quality Issues	Date 29/10/2020 (Two weeks)
Learning Objectives: Design virtual impedance loops for load sharing and power quality Improvement	
UNIT 1 TITLE: Virtual Impedance Concept	29/10/2020
UNIT 2 TITLE: Primary Harmonic Sharing via Inner Control Loops	05/11/2020

PEDAGOGICAL TOOLS
Study materials: Video, Lecture Slides, Research Papers, Simulation handbook

Assessment: Multi-choice Question, Simulation-based report
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

2.4.2.3 Learning Material: Maritime Microgrids – A Sustainable Solution for Green Sea Transportation

Course Title	An Introduction to DC Microgrids for Energy Control and Management
To be published: 15/10/2020 Closing date: 12/11/2020	Coauthors: Professor Josep M. Guerrero Prof. Tomasz Tarasiuk Dr. Giorgio Sulligoi
Overview	Nowadays, an important kind of terrestrial islanded microgrids can be found in Maritime power systems. For example, under normal operating conditions, the ship power system can be considered as a typically isolated microgrid and its characteristics, including variable frequency, match to terrestrial islanded microgrids. This course starts with the introduction of the conventional microgrid and then provides an overview of the present and future architectures of maritime microgrids, associated control technologies, optimization methods, power quality issues and state of the art solutions. The significant role of power electronics in realizing maritime microgrids, challenges in meeting high power requirements and regulations in the maritime industry, state-of-the-art power electronic technologies and future trends are also presented in this course.
Learning Objectives and Outcomes	● Illustrate the shipboard power system and integrated electric applications in ships. ● Analyse maritime microgrid characteristics and power quality challenges in shipboard microgrid power systems ● Categorize the ship's power systems evolution and identify the directions for future research challenges.

LESSON 1: Introduction to Microgrids	Date: 15/10/2020
Learning Objectives: Recognize the importance of Microgrids as a reliable, resilient and efficient technology for the integration, distribution, and utilization of renewable / non-renewable based generation and storage resources.	
UNIT 1 TITLE: Distributed Renewable/Non-renewable Energy Resources	
UNIT 2 TITLE: Overview of Microgrid Technology	
UNIT 3 TITLE: Microgrid Configurations and Examples	

PEDAGOGICAL TOOLS
Study materials: Video, Lecture Slides, Research Papers, Magazine Articles, MS/Ph.D. Thesis
Assessment: Multi-choice Question
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 2: Introduction to Shipboard power system	Date 22/10/2020
Learning Objectives: Illustrate the shipboard power system and integrated electric applications in ships.	
UNIT 1 TITLE: Ships power system evolution	
UNIT 2 TITLE: Shipboard electrical applications	
UNIT 3 TITLE: Integrated Electrical/Electronic ships Power Systems design	

PEDAGOGICAL TOOLS

Study materials: Video, Lecture Slides, Research Papers, Magazine Articles, MS/Ph.D. Thesis
Assessment: Multi-choice Question
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 3: Shipboard Microgrid configurations	Date 29/10/2020
Learning Objectives: Categorize the ship's power systems evolution and identify the directions for future research challenges	
UNIT 1 TITLE: The Current war (AC v/s DC)	
UNIT 2 TITLE: Comparison between AC and DC Shipboard Microgrids	
UNIT 3 TITLE: DC Shipboard Microgrid Example Projects	

PEDAGOGICAL TOOLS
Study materials: Video, Lecture Slides, Research Papers, Magazine Articles, MS/Ph.D. Thesis
Assessment: Multi-choice Question
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 4: Power Quality Challenges in Shipboard Microgrids	Date 05/11/2020
Learning Objectives: Analyse maritime microgrid characteristics and power quality challenges in shipboard microgrid power systems	
UNIT 1 TITLE: Introduction to Power Quality in Maritime Microgrids	

UNIT 2 TITLE: Power quality assessment in marine microgrids	
UNIT 3 TITLE: Recommendations for measurement of PQ disturbances in maritime microgrids	

PEDAGOGICAL TOOLS
Study materials: Video, Lecture Slides, Research Papers, Simulation handbook
Assessment: Multi-choice Question, Simulation-based report
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

2.4.2.4 Learning Material: An Introduction to AC Microgrids for Energy Control and Management

Course Title	An Introduction to AC Microgrids for Energy Control and Management
To be published: 15/10/2020 Closing date: 12/11/2020	Coauthors: Professor Josep M. Guerrero Professor Juan C. Vasquez Dr. Yajuan Guan
Overview	A microgrid is an electrically interconnected network of distributed energy resources including renewable/non-renewable generation resources, storage and loads in a closed locality to enhance the reliability, and efficiency of generation, distribution and utilization. The modules of the course are dedicated to the overview of microgrid technology giving some Microgrids examples around the world and how power electronics converters are integrated to form AC pico, nano, and smart Microgrids.

Learning Objectives and Outcomes	• Illustrate the concepts of distributed AC power systems and microgrids. • Define and explain various configurations and applications of AC microgrid systems. • Design various control schemes for power electronic converters employed in AC microgrids including voltage source inverter (VSI) • Illustrate how power electronics converters are integrated to form AC pico, nano and smart Microgrids with their operation and control in grid-connected and islanded mode

LESSON 1: Introduction to Microgrids	Date 15/10/2020
Learning Objectives: Recognize the importance of Microgrids as a reliable, resilient and efficient technology for the integration, distribution, and utilization of renewable/non-renewable based generation and storage resources.	
UNIT 1 TITLE: Distributed Renewable/Non-renewable Energy Resources	
UNIT 2 TITLE: Overview of Microgrid Technology	
UNIT 3 TITLE: Microgrid Configurations and Examples	

PEDAGOGICAL TOOLS
Study materials: Video, Lecture Slides, Research Papers, Magazine Articles, MS/Ph.D. Thesis
Assessment: Multi-choice Question
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 2: Introduction to AC Microgrids	Date 22/10/2020
Learning Objectives: Define and explain various configurations and applications of AC microgrid systems.	

UNIT 1 TITLE: Configurations and Architecture of AC Microgrids	
UNIT 2 TITLE: AC Microgrid Applications and Example Projects	
UNIT 3 TITLE: Storage Systems and UPS Systems	

PEDAGOGICAL TOOLS
Study materials: Lecture Slides, Research Papers, Magazine Articles, MS/Ph.D. Thesis
Assessment: Video, Multi-choice Question
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 3: Voltage Source Inverter (VSI) as an integral component of AC Microgrids	Date 29/10/2020
Learning Objectives: Design various control schemes for power electronic converters employed in AC microgrids including voltage source inverter (VSI)	
UNIT 1 TITLE: Design of Control Loops for VSIs	
UNIT 2 TITLE: Evaluation of a Stand-alone VSI with Voltage Control	

PEDAGOGICAL TOOLS
Study materials: Lecture Slides, Research Papers, Simulation handbook
Assessment: Video, Multi-choice Question, Simulation-based report
Blog post Dissemination/Communication: YES
Virtual classroom: NO

Conversation tool: YES

LESSON 4: Modes of operation for AC Microgrids	Date 05/11/2020
Learning Objectives: Illustrate how power electronics converters are integrated to form AC pico, nano and smart Microgrids with their operation and control in grid-connected and islanded mode	
UNIT 1 TITLE: Grid Connected Mode of operation	
UNIT 2 TITLE: Islanded Mode of Operation	

PEDAGOGICAL TOOLS
Study materials: Video, Lecture Slides, Research Papers, Simulation handbook
Assessment: Multi-choice Question, Simulation-based report
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

2.4.2.5 Learning Material: An Introduction to DC Microgrids for Energy Control and Management

Course Title	An Introduction to DC Microgrids for Energy Control and Management
To be published: 15/10/2020 Closing date: 12/11/2020	Coauthors: Professor Josep M. Guerrero Professor Juan C. Vasquez Dr. Mashood Nasir

Overview	A microgrid is an electrically interconnected network of distributed energy resources including renewable/non-renewable generation resources, storage and loads in a closed locality to enhance the reliability, and efficiency of generation, distribution and utilization. DC has paved its way in Datacenter, Electrical vehicles and Telecommunication stations due to higher distribution efficiency and better reliability aspects. Moreover, clean energy technologies e.g. Solar PV, Fuel Cells, battery storage systems and electronic loads are inherently DC in nature. Therefore, DC distribution and DC microgrids are clear trends in electrical networks. The focus of this course is on the understanding of DC microgrids, its configurations, and applications. The course also focuses on the introduction of modeling, control, and operation of DC Microgrids. The course also shows DC microgrids in different applications such as telecommunication systems, residential DC electrical distribution systems, and off-grid rural electrification networks.
Learning Objectives and Outcomes	● Recognize understand the importance of DC Microgrids as a reliable, resilient and efficient technology for the integration, distribution, and utilization of renewable/non-renewable based generation and storage resources. ● Illustrate various architectures, configurations, and applications of DC Microgrids at the residential, commercial and industrial levels. ● Design various control schemes for individual power electronic converters and multiple parallel converters for DC microgrids operation.

LESSON 1: Introduction to Microgrids	Date 15/10/2020
Learning Objectives: Recognize understand the importance of DC Microgrids as a reliable, resilient and efficient technology for the integration, distribution, and utilization of renewable/non-renewable based generation and storage resources	
UNIT 1 TITLE: Distributed Renewable/Non-renewable Energy Resources	
UNIT 2 TITLE: Overview of Microgrid Technology	
UNIT 3 TITLE: Microgrid Configurations and Examples	

PEDAGOGICAL TOOLS

Study materials: Video, Lecture Slides, Research Papers, Magazine Articles, MS/Ph.D. Thesis
Assessment: Multi-choice Question
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 2: Introduction to DC Microgrids	Date 22/10/2020
Learning Objectives: Illustrate various architectures, configurations, and applications of DC Microgrids at the residential, commercial and industrial levels.	
UNIT 1 TITLE: The Current war (AC v/s DC)	
UNIT 2 TITLE: Comparison between AC and DC Microgrids	
UNIT 3 TITLE: Advantages of DC Microgrids	
PEDAGOGICAL TOOLS	
Study materials: Video, Lecture Slides, Research Papers, Magazine Articles, MS/Ph.D. Thesis	
Assessment: Multi-choice Question	
Blog post Dissemination/Communication: YES	
Virtual classroom: NO	
Conversation tool: YES	

LESSON 3: DC Microgrid Configurations and Applications	Date 29/10/2020
Learning Objectives: Identify various power electronic converters employed for DC microgrid operation.	

UNIT 1 TITLE: Configurations and Architecture of DC Microgrids	
UNIT 2 TITLE: DC Microgrid Applications	
UNIT 3 TITLE: DC Microgrid Example Projects	

PEDAGOGICAL TOOLS
Study materials: Video, Lecture Slides, Research Papers, Simulation handbook
Assessment: Multi-choice Question, Simulation-based report
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 4: Basic Control Theory for DC Microgrids	Date 05/11/2020
Learning Objectives: Design various control schemes for individual power electronic converters and multiple parallel converters for DC microgrids operation.	
UNIT 1 TITLE: Voltage and Current Loops	
UNIT 2 TITLE: Droop Control	

PEDAGOGICAL TOOLS
Study materials: Video, Lecture Slides, Research Papers, Simulation handbook
Assessment: Multi-choice Question, Simulation-based report
Blog post Dissemination/Communication: YES
Virtual classroom: No
Conversation tool: YES

2.4.2.6 Learning Material: Challenges and solutions in Future Power Networks

Course Title	Challenges and solutions in Future Power Networks
To be published 30/03/2020 Closing date 05/04/2020	Coauthors: Ferdinanda Ponci, Ph.D.; Univ.-Prof. Antonello Monti, Ph.D.; Gianluca Lipari, Ph. D.; David Raisz Ph. D.; Sriram Karthik Gurumurthy, M. Sc.; Dr.-Ing. Aysar Musa; Steffen Vogel, M. Sc., Marco Pau, Ph. D.
Overview	This course allows the participants to keep with the trends regarding new and innovative energy and ICT solutions for the power network of the future.
Learning Objectives	• Understand and define the challenges in future power systems • Understand how new control techniques can be used for addressing the challenges • Understand how real time simulations help in testing new solutions for future power systems • Understand how monitoring systems enable key functions in future power systems
Outcomes	**see learning objectives**

LESSON 1: The challenges in future power systems	Date 06/04/2020 and 13/04/2020
Learning Objectives	- Understand and define the challenges in future power systems
UNIT 1: Today's and Tomorrow's Networks	
Lecture Slides and Video:	Today's and Tomorrow's Networks
Tags:	Frequency control, voltage control, distributed generation, power-electronic based grids
UNIT 2: Cybersecurity for Critical	

Infrastructures	
Lecture Slides and Video:	Cybersecurity for Critical Infrastructures
Tags:	Critical infrastructures, cybersecurity, cyber attacks, ICT infrastructure, security solutions

PEDAGOGICAL TOOLS
Study materials Lecture Video: https://www.youtube.com/watch?v=A_q9Bp6bo-I&list=PLiSthLN7M9r7JuF_JnDwtSQFb_boRBX4t&index=2 Readings: https://www.re-serve.eu/files/reserve/Content/Deliverables/727481_RESERVE_D1.6.pdf Lecture Video: https://www.youtube.com/watch?v=XngcJVuXzVQ&list=PLiSthLN7M9r7JuF_JnDwtSQFb_boRBX4t&index=12
Assessment: Multiple-choice Questions
Blog post: No
Virtual classroom: No
Conversation tool: Yes

LESSON 2: New control techniques	Date 20/04/2020, 27/04/2020 and 04/05/2020
Learning Objectives	Understand how new control techniques can be used for addressing the challenges
UNIT 1: Linear Swing Dynamics	
Lecture Slides and Video:	Linear Swing Dynamics: a new approach to frequency control
Tags:	Inertia, Fast-frequency control, RoCoF, Linear Swing Dynamics, Frequency Control

UNIT 2: New voltage control techniques	
Lecture Slides and Video:	New voltage control techniques
Tags:	Voltage stability, virtual impedance control, virtual impedance measurements
UNIT 3: Frequency Control & Stability in Future Power Electronics Networks	Voltage stability, virtual impedance control, virtual impedance measurements
Lecture Slides and Video:	Frequency Control & Stability in Future Power Electronics Networks
Tags:	Frequency Control, Agent-Based Frequency Control, Hybrid AC-DC Systems
UNIT 4: Dynamic Voltage Stability	
Lecture Slides and Video:	Dynamic Voltage Stability
Tags:	Voltage stability, virtual impedance control, virtual impedance measurements

PEDAGOGICAL TOOLS
Study materials Lecture Videos: https://www.youtube.com/watch?v=3iQESilmXlU&list=PLiSthLN7M9r7JuF_JnDwtSQFb_boRBX4t&index=4 https://www.youtube.com/watch?v=6hv8jBniZ98&list=PLiSthLN7M9r7JuF_JnDwtSQFb_boRBX4t&index=5 https://www.youtube.com/watch?v=3551IrXVxAE&list=PLiSthLN7M9r7JuF_JnDwtSQFb_boRBX4t&index=15 https://www.youtube.com/watch?v=_pYe5h-0rj0&list=PLiSthLN7M9r7JuF_JnDwtSQFb_boRBX4t&index=18 Readings: D. Raisz, A. Musa, F. Ponci and A. Monti, "Linear and Uniform Swing Dynamics," in *IEEE Transactions on Sustainable Energy*, vol. 10, no. 3, pp. 1513-1522, July 2019, available online: https://ieeexplore.ieee.org/document/8718333 S. K. Gurumurthy, M. Cupelli and A. Monti, "A Generalized Framework for Synthesizing

Virtual Output Impedance Control of Grid Integrated Power Electronic Converters," *2018 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES)*, Chennai, India, 2018, pp. 1-6., available online: https://ieeexplore.ieee.org/document/8707895
Assessment: Multiple-choice Questions

LESSON 3: Real-Time Simulations	Date 11/05/2020
Learning Objectives	Understand how real time simulations help in testing new solutions for future power systems
UNIT 1: Real time simulation tools	
Lecture Slides and Video:	Introduction to real time simulation tools
Tags:	Real-time simulations, Hardware-in-the-loop, RTDS, Pan-European real-time simulation

PEDAGOGICAL TOOLS
Study materials Video Lecture: https://www.youtube.com/watch?v=l59JAR6llsM&list=PLiSthLN7M9r7JuF_JnDwtSQFb_boRBX4t&index=16 Readings S. Vogel, M. Mirz, L. Razik and A. Monti, "An open solution for next-generation real-time power system simulation," *2017 IEEE Conference on Energy Internet and Energy System Integration (EI2)*, Beijing, 2017, pp. 1-6. Available online: https://ieeexplore.ieee.org/document/8245739 M. Stevic and A. Monti, "A Bilateral Teleoperation Approach for Interface Algorithms in Distributed Real-Time Simulations," *2018 IEEE Workshop on Complexity in Engineering (COMPENG)*, Florence, 2018, pp. 1-5. Available online: https://ieeexplore.ieee.org/document/8536241

Assessment: Multiple-choice Questions
Blog post: No
Virtual classroom: No
Conversation tool: Yes

LESSON 4: Monitoring systems	Date 18/05/2020
Learning Objectives	Understand how monitoring systems enable key functions in future power systems
UNIT 1: Monitoring of Power Systems	
Lecture Slides and Video:	Monitoring of Power Systems
Tags:	State Estimation, Classical State Estimation, Multi-Area State Estimation

PEDAGOGICAL TOOLS
Study materials Lecture Videos: https://www.youtube.com/watch?v=9bi2I7naFKQ&list=PLiSthLN7M9r7JuF_JnDwtSQFb_boRBX4t&index=17 Readings: M. Pau, F. Ponci and A. Monti, "Impact of Network Parameters Uncertainties on Distribution Grid Power Flow," *2019 International Conference on Smart Energy Systems and Technologies (SEST)*, Porto, Portugal, 2019, pp. 1-6. Available online: https://ieeexplore.ieee.org/document/8849030 C. G. C. Carducci, G. Lipari, N. Bosbach, T. D. Raimondo, F. Ponci and A. Monti, "A Versatile Low-Cost OS-based Phasor Measurement Unit," *2019 IEEE International Instrumentation and Measurement Technology Conference (I2MTC)*, Auckland, New Zealand, 2019, pp. 1-6. Available online: https://ieeexplore.ieee.org/document/8826894

Assessment: Multiple-choice Questions
Blog post: No
Virtual classroom: No
Conversation tool: Yes

2.4.2.7 Learning Material: Innovation and Diversity in Engineering

Course Title	Innovation and Diversity in Engineering
To be publish 01/10/2020 Closing date 15/10/2020	Coauthors: Prof. Dr. Carmen Leicht-Scholten; Julia Berg, M.Sc.
Overview	The course deals with the context between the development of sustainable innovations and diversity and with the question of how culture shapes and impacts engineering. A MOOC will be developed to understand the diversity among people with whom you work in technology-based enterprises, and for whom you design products and services. We will not only have text but also group works and give room for discussions and the exchange of different views and ideas.
Learning Objectives	Enhancing students' understanding of diversity among people with whom they work and for whom they design products and services

Outcomes	After completing the course, students will be able to: - explain and compare different gender and diversity approaches - knowledgeably discuss the context between diversity and innovation - create transfer between stereotyping, labelling and social processes - identify and discuss the cultural aspects of gender and diversity as well as its impact on the career choice, the task selection and the quality of developed solutions, design, technologies and products - evaluate the complex impact of social aspects for learning and working in research, development and engineering - work self-organized and improve their presentation competence, being able to work with the concepts of intersectionality (gender and diversity) as well as their ability to work in an interdisciplinary team

LESSON 1: Gender and diversity approaches	Date: October 2020
Learning Objectivesį	Explaining and comparing different gender and diversity approaches
UNIT 1: Gender approaches	
Video Lecture	Gender and Diversity approaches
Tags:	Gender approaches, gender in science
Assignment	Text work, group work
UNIT 2: Diversity approaches	
Video Lecture	Gender and Diversity approaches
Tags:	Diversity approaches, diversity in science

Assignment	Text work, group work
PEDAGOGICAL TOOLS	
Study materials: Video lecture, text work, group work	

LESSON 2: Innovation and diversity	Date October 2020
Learning Objectives	Knowledgeably discussing the context between diversity and innovation
UNIT 1: Diversity categories	
Video Lecture	Innovation and diversity
Tags:	Diversity categories, diversity in engineering
Assignment	Text work, discussion of studies/literature reflecting own experiences and assumptions
UNIT 2: Dimensions of innovation	
Video Lecture	Innovation and diversity
Tags:	Dimensions of innovation, social innovation
Assignment	Text work, discussion of studies/literature reflecting own experiences and assumptions
PEDAGOGICAL TOOLS	
Study materials: Video lecture, text work, group work	

LESSON 3: Innovation and ethics	Date October 2020
Learning Objectives	Creating transfer between stereotyping, labelling and social processes
UNIT 1: Stereotyping and Innovation	
Video Lecture	Innovation and ethics
Tags:	Stereotyping, labeling, social processes, stereotyping and innovation
UNIT 2: (Engineering) Ethics	
Video Lecture	Innovation and ethics
Tags:	Engineering ethics
UNIT 3: Ethics and innovation	
Video Lecture	Innovation and ethics
Tags:	Ethics and innovation, responsible innovation
PEDAGOGICAL TOOLS	
Study materials: Video lecture, text work, group work	

LESSON 4: Culture and diversity	Date November 2020
Learning Objectives	Identifying and discussing the cultural aspects of gender and diversity as well as its impact on the career choice, the task selection and the quality of developed solutions, design, technologies, and products
UNIT 1: Culture	
Video Lecture	Culture and diversity

Tags:	Cultural aspects of gender and diversity
UNIT 2: Culture and teamwork	
Content	Discussion: Cultural Differences and their Effects on organizations/teamwork
Tags:	Culture and teams, culture and organizations
PEDAGOGICAL TOOLS	
Study materials: Video lecture, text work, role play	

LESSON 5: Engineering culture	Date _November 2020
Learning Objectives	Identifying and discussing he cultural aspects of gender and diversity as well as its impact on the career choice, the task selection and the quality of developed solutions, design, technologies, and products
UNIT 1: Engineering culture	
Video Lecture	Engineering culture
Tags:	Engineering culture, engineering habitus
PEDAGOGICAL TOOLS	
Study materials: Video lecture, text work, role play	

LESSON 6: The impact of social aspects	Date November 2020
Learning Objectives	Evaluating the complex impact of social aspects for learning and working in research, development, and engineering

UNIT 1: Social aspects	
Video Lecture	The impact of social aspects
Tags:	Socials aspects
PEDAGOGICAL TOOLS	
Study materials: Video lecture, text work, group work	

Table 19: Learning Material: Renewable Energy Technologies

Course Title	Renewable Energy Technologies
To be publish 04/27/2020 Closing date 22/06/2020	Coauthors: Francesco Calise, Massimo Dentice D'Accadia, Maria Vicidomini
Overview	Renewable energy sources play a key role in the transition toward a zero-carbon society: by 2050, they are expected to supply more than 2/3 of the global energy demand, strongly contributing to reducing greenhouse gas emissions and limiting the effects of global warming. The MOOC offers an up-dated and comprehensive overview of renewable energy technologies, from technical and economic perspectives.
Learning Objectives	The MOOC provides the basis for understanding and analyzing the most important Renewable Energy Sources (RES) and technologies from fundamental scientific principles; consideration about the technical and economic feasibility of RES-based systems are included.
Outcomes	At the end of the course, students will be able to: · describe fundamentals and main characteristics of renewable energy sources and technologies and their differences compared to fossil fuels; · evaluate the effects that current energy systems based on fossil fuels have over the environment and the

	advantages of renewable energy sources; · compare different renewable energy technologies and
	choose the most appropriate based on local conditions; · perform simple energy, environmental and techno-economical assessments of renewable energy systems; · design, at least at a preliminary level, renewable/hybrid energy systems; · discuss how to utilize local energy sources to improve the sustainability of energy-related activities.

LESSON 1: Introduction: energy transition and the role of renewable energy technologies	Date: April 27, 2020
Learning Objectives	Students will understand the difference between conventional and renewable energy sources; data about their availability and environmental impact will be provided. In addition, they will learn how to analyze a renewable-based energy system, from both technical and economic viewpoints.
Unit 1: Classification and availability of energy sources	
Content	Classification and availability of energy sources. Overview of renewable energy technologies. Environmental impact (greenhouse gas emissions) of energy sources.
Tags:	Fossil fuels. Nuclear energy. Renewables. Greenhouse gas emissions.
Assignment n.: 1	Quiz n.:1
Peer assessment	No

UNIT 2: Integration of renewable energy technologies	
Content	Technical, economic and social issues related to the development and integration of renewable energy technologies into electric, natural gas and thermal energy distribution networks.
Tags:	Distributed generation. Smart grid. Energy networks. Energy storage.
Assignment n.: 1	Quiz n.: 1
Peer assessment	No

UNIT 3: Introduction to technical and economic analysis of energy systems	
Content	Methods and criteria for evaluating the economic profitability of investments in energy efficiency and renewable energy systems.
Tags:	Energy saving; avoided emissions of greenhouse gases; Energy Return on Investment; Levelized Cost of Energy; Pay-back time; Net Present Value; Internal Rate of Return of investment.
Assignment n.: 1	Quiz n.1
Peer assessment	Yes

LESSON 2: Solar energy: availability	Date: May 4, 2020
Learning Objectives	Students will learn how to calculate the amount of solar energy available at a given location and time of day on Earth and how to maximize the capture of solar radiation. An overview of solar energy technologies is also provided

UNIT 1: Basic principles of solar energy collection	
Content	Solar geometry, solar radiation availability and collection: engineering basic concepts. How to determine the incoming solar energy for solar devices How to determine the incoming solar energy for solar devices.
Tags:	Solar geometry. Collection of solar energy. Solar maps.
Assignment n.: 1	Quiz n.: 1
Peer assessment	No
UNIT 2: Overview of solar energy technologies	
Content	Classification and main characteristics of solar energy technologies: solar thermal systems, Photo-Voltaic systems (PV), Concentrated Solar Power systems (CSP).
Tags:	Solar collectors. Photo-Voltaic systems (PV). Concentrated Solar Power systems (CSP).
Assignment n.: 1	Quiz n.: 1
Peer assessment	No

LESSON 3: Solar thermal systems	Date: May 11, 2020
Learning Objectives	At the end of the lesson, students will be able to: · articulate the technical and economic fundamentals of solar thermal energy systems; · describe the spectrum of possible solar thermal technologies for a given application;

	· assess solar thermal technologies to identify the best solution for a given application.
UNIT 1: Overview of solar thermal systems	
Content	Classification, technical and economic characteristics of solar collectors.
Tags:	Solar thermal collectors. Flat plate, Evacuated tubes, concentrating solar collectors.
Assignment n.: 1	Quiz n.: 1
Peer assessment	No
UNIT 2: Performance of solar thermal collectors and systems	
Content	Ma Main factors affecting the performance of solar collectors. Solar thermal systems: classification, layouts, design criteria, performance; technical and economic assessment. Case studies. Ma Market situation and perspectives.
Tags:	Sol Solar thermal collectors. Solar energy storage. Solar Thermal systems.
Assignment n.: 2	Quiz n.: 1
Peer assessment	NO

UNIT 3: Advances in solar thermal technologies	

Content	Solar cooling, drying, desalination, industrial applications.
Tags:	Solar cooling. Solar drying. Solar desalination.
Assignment n.: 1	Quiz n.: 0
Peer assessment	No

LESSON 4: Photovoltaic and Concentrated Solar Power systems	Date: May 18, 2020
Learning Objectives	At the end of the lesson, students will be able to: • articulate the technical and economic fundamentals of Photo-Voltaic (PV) and Concentrated Solar Power (CSP) systems; • describe the spectrum of possible solar power technologies for a given application; • assess solar power technologies to identify the best solution for a given application.
UNIT 1: Overview of solar power technologies	
Content	Classification and technical characteristics of solar power technologies.
Tags:	Solar Power Systems. Photo-Voltaic systems (PV).
Assignment n.: 1	Quiz n.: 1
Peer assessment	No
Unit 2: Photo-Voltaic systems (PV)	
Content	Photovoltaic principle. PV systems: classification, layouts, design criteria. Performance assessment of PV cells, modules and systems. Case studies.

	Market situation and perspectives. Recent innovations in PV systems.
Tags:	Photo-Voltaic (PV) energy. Electric energy storage.
Assignment n.: 1	Quiz n.:1
Peer assessment	No

UNIT 3: Concentrating Solar Power system (CSP)	
Content	CS Power systems: classification, layouts, design criteria. Performance assessment of CSP systems. Case studies. Market situation and perspectives. Recent innovations in CSP systems.
Tags:	Solar energy concentration. Solar Power. Parabol Trough collectors; Fresnel collectors; Dish collector Solar towers.
Assignment n.: 2	Quiz n.: 1
Peer assessment	No

LESSON 5: Wind energy	Date: May 25, 2020
Learning Objectives	At the end of the lesson, students will be able to: • articulate the technical and economic fundamentals of wind power systems; • describe the spectrum of possible wind power technologies for a given application; • assess wind power systems to identify the best solution for a given application.

UNIT 1: Wind power conversion	
Content	Wind resources. Classification and working principle of wind turbine Power coefficient. Design criteria. Control strategies. Characteristic curves
Tags:	Wind turbines. Micro-wind turbines. Bets limit. Power coefficient
Assignment n.: 1	Quiz n.: 1
Peer assessment	No
Unit 2: Technical and economic assessment of wind power systems	
Content	Wind analysis; anemological study of a site; wind maps; Technical and power forecasting. Technical and economic assessment of wind power systems: criteria and tools. Case studies. Market situation and perspectives
Tags:	Wind speed. Anemology. Weibull distribution
Assignment n.: 1	Quiz n.: 1
Peer assessment	No

LESSON 6: Hydropower	Date: June 8, 2020

Learning Objectives	At the end of the lesson, students will be able to: • articulate the technical and economic fundamentals of hydropower systems; • describe the spectrum of possible hydropower technologies for a given application; • assess hydropower systems to identify the best solution for a given application.
UNIT 1: Hydroelectric conversion	
Content	Hydroelectric resources. Classification and working principle of hydraulic turbines. Design criteria. Control strategies. Characteristic curves
Tags:	Hydraulic turbines. Mini and micro-hydroelectric systems. Betz limit. Power coefficient.
Assignment n.: 1	Quiz n.: 1
Peer assessment	No
Unit 2: Technical and economic assessment of hydropower systems	
Content	Hydroelectric resource analysis. Technical and economic assessment of hydropower systems: criteria and tools. Case studies. Market situation and perspectives
Tags:	Flow duration curve. Minimum environmental flow.
Assignment n.: 1	Quiz n.: 1
Peer assessment	No

Unit 3: Innovation in hydropower	
Content	Advances in hydropower systems. Pumps as Turbines in water distribution networks. Wave and tidal energy
Tags:	Pumps As Turbines. Wave and tidal energy.
Assignment n.: 1	Quiz n.: 1
Peer assessment	No

LESSON 7: Geothermal energy	Date: June 8, 2020
Learning Objectives	At the end of the lesson, students will be able to: · articulate the technical and economic fundamentals of geothermal power systems, ground source heat pumps and other geothermal systems; · describe the spectrum of possible geothermal energy technologies for a given application; · assess geothermal energy systems to identify the best solution for a given application.
UNIT 1: Geothermal resource and systems	
Content	Geothermal energy sources. Low, medium and high enthalpy geothermal sources. Medium and high enthalpy geothermal systems. Potential environmental impact. Direct usages (including heat pumps). Indirect usages (electricity generation).
Tags:	Dry rocks. Hot aquifers. Extraction techniques.
Assignment n.: 1	Quiz n.: 1

Peer assessment	No
Unit 2: Technical and economic assessment of geothermal energy systems	
Content	Availability analysis of a geothermal source. Technical and economic assessment of geothermal systems: criteria and tools. Case studies. Ma Market situation and perspectives
Tags:	Ground-source heat pumps. Geothermal power.
Assignment n.: 1	Quiz n.: 1
Peer assessment	No

LESSON 8: Biomass energy	**Starting Date: June 8, 2020**
Learning Objectives	At the end of the lesson, students will be able to: · describe the nature and principle of different types of biomass; · choose the suitable biomass fuels for different bio-energy applications; · articulate the technical and economic fundamentals of biomass-to-energy systems; · describe the spectrum of possible biomass-based technologies for a given application; · assess biomass energy systems to identify the best solution for a given application.
UNIT 1: Introduction to biomass energy	
Content	Overview of biomass energy. Classification of biomass. Renewable feedstocks and their production. Feedstocks availability, characterization and attributes for biofuel/bioenergy production.
Tags:	Bioenergy. Biofuels. Biofeedstock. Waste and residues.

Assignment n.: 1	Quiz n.: 1
Peer assessment	No
Unit 2: Biomass-to-energy conversion	
Content	An Energy conversion processes: direct combustion; pyrolysis, gasification and other thermochemical conversion systems; bio-chemical processes (anaerobic digestion, alcoholic fermentation); biodiesel from vegetable oils and algae; waste-to-energy systems.
Tags:	Pyrolysis; gasification; biogas; syngas.
Assignment n.: 1	Quiz n.: 1
Peer assessment	No
Unit 3: Technical and economic Assessment of biomass energy systems	
Content	Technical and economic assessment of biomass energy systems: criteria and tool. Social and environmental issues. Case studies. Market situation and perspectives.
Tags:	Biomass energy. Waste-to-energy. Energy from residues.
Assignment n.: 1	Quiz n.: 1
Peer assessment	No

2.4.2.8 Learning Material: Electric heat pumps in the energy transition framework

Course Title: Electric heat pumps in the energy transition framework	

To be published March 2020	Coauthors: Prof. Nicola Bianco Prof. Alfonso William Mauro
Overview	The MOOC aims to give an overview of the heat pump technologies application in the context of the energy transition. In particular, using a case-based approach, the course will start with examples of the heating and cooling needs of the buildings then moving to the working principle and technologies of the electrically driven heat pumps. After examples of energy performance indicators calculations and dynamic simulation of the heat pump coupled to a building, the integration of the heat pumps into more complex systems (smart grids) is discussed, introducing the tools allowing heat storage and strategies for control (demand side management).
Learning Objectives	Once students have completed the course, they will be able to: • know the potential use of a heat pump in the energy transition framework • describe the heating and cooling load profile • do simple calculations of primary energy consumption and environmental impact • describe the heat pump working principle and
	understand the variation of the performance under variable boundary conditions • know the basics of different technologies • Estimate the performance of a heat pump according to standards • Size a heat pump and read critically the results of a dynamic simulation • describe the technologies for heat storage with heat pumps • know some examples of application in complex systems

LESSON 1 Electric heat pumps: the potential role in a scenario of large energy production by renewable sources	Date 15/04/2020
Learning Objectives	know the potential use of a heat pump in the energy transition framework
UNIT 1	the same of the lesson
Content	A description of the role which the technology of the heat pumps can have increasing the use of electricity produced by renewable sources
Tags:	heat pump, energy transition
Assignment n.	Quiz n. 3
Peer assessment	NO

PEDAGOGICAL TOOLS
Study materials
Blog post NO Dissemination/Communication NO
Virtual classroom NO
Conversation tool NO

LESSON 2 Heating and Cooling needs in building	Date 22/04/2020
Learning Objectives	describe the heating and cooling load profile
UNIT 1 : Introduction to the user types	

Content	A description of the different building categories and of the methods to calculate the heating and cooling load needs
Tags:	Heating, cooling, load, method
Assignment n.	Quiz n. 5
Peer assessment	NO
UNIT 2: Climate zones definitions according to EU regulations	
Content	Typical winter and summer profiles.
Tags:	Load, profile, winter, summer
Assignment n.	Quiz n. 5
Peer assessment	NO
UNIT 3 : A load profile for a case study	
Content	A detailed load profile description for a case study
Tags:	case study, load, profile
Assignment n.	Quiz n.5
Peer assessment	NO
PEDAGOGICAL TOOLS	
Study materials: NO	
Blog post NO Dissemination/Communication NO	
Virtual classroom NO	

Conversation tool NO	

LESSON 3 Primary energy consumption and environmental impact	Date 29/04/2020
Learning Objectives	Do simple calculations of primary energy consumption and environmental impact
UNIT 1: Primary energy consumption and environmental impact basic calculations	
Content	Description of the methods to calculate the energy consumption and the environmental impact
Tags:	energy, consumption, environmental impact, calculation
Assignment n.	Quiz n. 5
Peer assessment	NO
UNIT 2 : Comparison with a burner during the heating season	
Content	Energetic and environmental impact comparison between a heat pump and a burner during the heating season based on the basic calculations introduced before
Tags:	burner, heat pump
Assignment n.	Quiz n. 5
Peer assessment	NO
PEDAGOGICAL TOOLS	
Study materials NO	
Blog post NO	

Dissemination/Communication NO	
Virtual classroom	NO
Conversation tool	NO

LESSON 4 How does a heat pump work? Which factors do affect a heat pump operation?	Date 06/05/2020
Learning Objectives	describe the heat pump working principle and understand the variation of the performance under variable boundary conditions
UNIT 1 : Working principle for vapor compression systems and technical limits for operation	
Content	Working principle for vapor compression systems and technical limits for operation
Tags:	energy, consumption, environmental impact, calculation
Assignment n.	Quiz n. 5
Peer assessment	NO
UNIT 2 : Comparison with a burner during the heating season	
Content	Energetic and environmental impact comparison between a heat pump and a burner during the heating season based on the basic calculations introduced before
Tags:	burner, heat pump
Assignment n.	Quiz n. 5
Peer assessment	NO

PEDAGOGICAL TOOLS
Study materials NO
Blog post NO Dissemination/Communication NO
Virtual classroom NO
Conversation tool NO

LESSON 5 Recent technologies for heat pumps	Date 13/05/2020
Learning Objectives	know the basics of different technologies
UNIT 1 : High performance water chiller systems	
Content	Description of the technology related to the water chillers, with some information about the actual performance and technological limits
Tags:	water chillers, technology
Assignment n.	Quiz n. 5
Peer assessment	NO
UNIT 2 : Multiple unit direct expansion systems	
Content	Description of the technology related to systems with multiple units operating with direct expansion, with some information about the actual performance and

	technological limits
Tags:	split, system, VRF, VRV
Assignment n.	Quiz n. 5
Peer assessment	NO
UNIT 3 : Systems working with natural fluids	
Content	Description of the technology related to heat pumps operating with natural fluids, with some information about the actual performance and technological limits
Tags	CO2, propane, heat pumps, low charge
Assignment n.	Quiz n.5
Peer assessment	NO

PEDAGOGICAL TOOLS
Study materials NO
Blog post NO Dissemination/Communication NO
Virtual classroom NO
Conversation tool NO

LESSON 6: Estimation of seasonal performance indicators	Date 20/05/2020

Learning Objectives	Estimate the performance of a heat pump according to standards
UNIT 1 : Standards	
Content	Description of the regulations and standards which establish the method to be applied to calculate the performance indicators
Tags:	heat pump, SEER, SCOP
Assignment n.	Quiz n. 5
Peer assessment	NO
UNIT 2 : Example of calculation based on a case study	
Content	Application of the standards to the case study in order to calculate the SCOP indicator
Tags:	case study, SCOP
Assignment n.	Quiz n. 5
Peer assessment	NO

PEDAGOGICAL TOOLS
Study materials NO
Blog post NO Dissemination/Communication NO

Virtual classroom NO	
Conversation tool NO	

LESSON 7 Heat pump coupling to a building: a case study	Date 27/05/2020
Learning Objectives	Size a heat pump and read critically the results of a dynamic simulation
UNIT 1 : Sizing of the system	
Content	Criterion to size the system for a defined load
Tags:	sizing, heat pump
Assignment n.	Quiz n. 5
Peer assessment	NO
UNIT 2 : Description of the maps of performance and example of dynamic simulation of a heat pump	
Content	Examples of maps of performance. Example of the use of the maps in dynamic simulator with a discussion about the results
Tags:	maps, performance, dynamic simulation
Assignment n.	Quiz n. 5
Peer assessment	NO

PEDAGOGICAL TOOLS

Study materials NO
Blog post NO Dissemination/Communication NO
Virtual classroom NO
Conversation tool NO

2.4.2.9 Learning Material: Green Professionalization

Course title	Green professionalization and ethics
To be published 15/04/2020 Closing date 29/04/2020	Author: Dario Minervini
Overview	The energy transition is having an impact on the world of occupations and professions. Some job profiles are emerging, others are being innovated, incorporating sustainability sensitivity and values. This societal innovation involves different fields, from research to industry and consumption. “Green collars” have a pivotal role in translating socio-technical innovation “in practice” and in different territories (i.e., green energy facilities). In order to face this complexity, skills and knowledge are more and more hybrid, connecting technical skills with social ones. This set of knowledge and competences will be investigated with reference to some empirical case studies (e.g., the wind farm developers). In particular, the ethical declination of sustainability in professional life will be addressed and discussed.
Learning objectives	Participants will be able to retrace the combination of technical and social skills involved in green transitions, as well as, the ethics implication for the professionalization of the green-collars.
Outcomes	Participants will be able to identify professional skills to promote a sustainable energy transition. They will be able also to address the technological/users in order to promote a societal change fair and environmentally friendly (i.e., reduction of indoor energy consumption, adoption of e-car or sharing mobility).

LESSON 1 – Profession in transition	Date 15/04/2020
Learning objectives	Explain the essential aspects of the sociology of the professions and the emergence of the issue of sustainability in the professional world, addressing the social role of professions in the energy transition process.
Course Introduction	
Content	Presentation of the main issue of the course: professions, social change, energy transition. Questioning how professions are involved in the social dynamics responding to the environmental urgencies (video and slide).
UNIT 1 - Key concepts in the sociology of professions	
Content	Introduction to the sociology of professions. How analytically conceptualize professions as social groups? Theoretical approaches about the "professional" claim and the social construction of boundaries in the labor market (video and slide).
Tags:	Social groups, legitimation, and status
UNIT 2 – Professions dealing with energy transition.	
Content	This unit consists of one website page and three videos retrieved from youtube. The aim is to offer to the student's examples of how the social actors mentioned in the presentation and the previous unit depict: a) the social and environmental worth of the green jobs, b) their role in the energy transition process. Website n.1 National Geographic article about "11 of the Fastest Growing Green Jobs" https://www.nationalgeographic.com/environment/sustainable-earth/11-of-the-fastest-growing-green-jobs/ Video n. 1 Green jobs facing environmental urgencies. The ethics of the green economy? The point of view of the International Labour Organization (ILO). https://www.youtube.com/watch?v=NrNQzCjI8A4 Video n.2 Engineers, high education, new challenges of energy transitions. The point of view of the University of Aberdeen MSc Programme Coordinator (Engineering curriculum).

	https://www.youtube.com/watch?v=tpgTsgWA0Lw Video n.3 Architects and the planning of sustainable places for the future. The point of view of one of India's pioneering green architects. https://www.youtube.com/watch?v=9klc9BLqtGw
UNIT 3 – Readings, recap, and assessment	
Content	This unit is dedicated to recapping the arguments of the first lesson. Readings will help the students to review the concepts, while the Discussion board will be an opportunity of exchange and confrontation. Finally the assessment will be achieved by a test articulated as multiple choice and true/false questions.
Assignment n.	Readings: Reading 1 Environmental economy - statistics on employment and growth https://ec.europa.eu/eurostat/statistics-explained/pdfscache/41606.pdf Reading 2 Professionalism:Value and ideology, Julia Evetts (University of Nottingham) http://www.sagepub.net/isa/resources/pdf/Professionalism.pdf Discussion board On-line students discussion on the topics of the lesson Test multiple choice and true/ false questions

PEDAGOGICAL TOOLS	
Study materials:	Course slides, websites, videos, suggested readings
Virtual classroom	D
LESSON 2 – Experts and society in transition.	Date 22/04/2020
Learning objectives	Contextualize the argument of professionalism and expert knowledge in the risk society and in the climate change scenario.
Course Introduction	
Content	Presentation of the main issue of the lesson

Learning objectives	Professions, expertise and socio-technical and political controversies.
UNIT 1 – Experts and risk society	
Content	Questioning the social trust in experts and professionals in the scenario of the climate change.
Tags	Institutionalized knowledge, Trust, Climate change
Assignment n.	Quiz n.
UNIT 2 – Experts and environmental controversies	Environmental conflicts and politicization of expertise: analytical dimensions and case-based discussion.
Content	Socio-environmental conflicts, politicization or neutralization of the environmental issue
Assignment n.	Quiz n.
UNIT 3 – Readings, recap, and assessment	
Content	This unit is dedicated to recapping the arguments of the first lesson. Readings will help the students to review the concepts, while the Discussion board will be an opportunity of exchange and confrontation. Finally, the assessment will be achieved by a test articulated as multiple choice and true/false questions.

PEDAGOGICAL TOOLS	
Study materials:	Course slides, websites, videos, suggested readings
Virtual classroom	D
LESSON 3– Green-collars and professionalization process	Date 29/04/2020
Course Introduction	
Content	Presentation of the main issue of the lesson
Learning objectives	Understanding the professionalization process of new green jobs: new job profiles and professional values.
UNIT 1 –Green sector and new socio-technical skills demand	

Content	Green jobs and green professions: assembling technical and social skills to face the environmental issue.
Tags	environment, professionalization, new skills
Assignment n.	Quiz n.
UNIT 2 – Wind-farm developer: an example of "green-collar"	The wind-farms developer. The "professionalization" process. Knowledge setting: technical skills, social competences and situated-professional practices.
Content	Local contexts, wind power, new green professions
Tags	
Assignment n.	Quiz n.
Content	This unit is dedicated to recap the arguments of the first lesson. Readings will help the students to review the concepts, while the Discussion board will be an opportunity of exchange and confrontation. Finally the assessment will be achieved by a test articulated as multiple choice and true/false questions.
PEDAGOGICAL TOOLS	
Study materials:	Course slides, websites, videos, suggested readings
Virtual classroom	D
Conversation tool	NO

2.4.2.10 Learning Material: Corporate Communication and Corporate Social Responsibility

Course title	Corporate Communication and Corporate Social Responsibility
To be published 15/4/2020 Closing date 20/5/2020	Coauthors: Ivano Scotti
Overview	Social and environmental responsibility has become a common issue in corporate communication, but how to design an efficient communication plant? Why did the subject of 'responsibility' become a relevant topic? Which role is playing ICT in corporate communication? Are they suitable for the communication of corporate social responsibility? This course offers insight on corporate social responsibility and communication reporting the connections among organizational models, communicational

	functions, consumption trends, new communication technologies, and socio-environmental crises. The course will show examples of the communication of energy companies and how they face the socio-environmental responsibility in marketing communication and public relations.
Learning objectives	Participants will learn communication strategies and tools, as well as social corporate responsibility tools.
Outcomes	Participants will be able to evaluate, investigate and design a communication plan focusing on socio-environmental issues.

LESSON 1 – Organization & Communication	Date 15/04/2020
Learning objectives	In this lesson are provides insights about the contemporary social change and corporate transformation. A specific topic is dedicated to the concept of “relation” in corporate actions..
UNIT 1 – From industrial to post-industrial society	
Content	The unit aims to show socio-economic change through the conceptual category of "post-industrial"..
Tags	Post-material values, social construction of space & time, individualization.
Assignment n.	Quiz n.
Peer assessment	
UNIT 2 – Corporate changes	
Content	The unit is dedicated to the change in the organizational model of companies and management style
Tags	Consumer-centered company, service, social relations
Assignment n.	Quiz n.

Peer assessment	
UNIT 3 – New corporate models (classroom activity)	
Content	Reading activity on the lesson issue.
Tags	Knowledge society, post-industrial society, new values
Assignment n.	Quiz n.
Peer assessment	

PEDAGOGICAL TOOLS	
Study materials	Course slides and suggestion readings (open-access or available on-line) http://www.academia.edu/download/32997874/Stehr__Nico__The_Economic_Structure_Paper_presented_at_the_conference_on_Social_Progress_and_Sociological_Theory_KRACOW_1988.docx

LESSON 2 – Organization & Communication	Date 22/04/2020
UNIT 1 –The organization in a sociological perspective	
Content	Basics of organizational analysis in a sociological perspective. The unit focus on some authors
Tags	Organization, material aspects, socio-cultural dimensions.
Assignment n.	Quiz n.
UNIT 2 – Communication needs	
Content	The unit offers insight on the analysis of the relationship between organizational models and communication needs.

Tags:	Communication, corporations, social dimensions
Assignment n.	Quiz n.
UNIT 3 –Organizational communication (classroom activity)	
Content	Reading activity on the lesson issue.
Tags:	Organizational communication, organizational models
Assignment n.	Quiz n.
Peer assessment	

PEDAGOGICAL TOOLS	
Study materials	Course slides and suggestion readings (open-access or available on-line) https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1460-2466.2004.tb02652.x?casa_token=LBKDMN2kBGAAAAAA%3AIKA6aWwPWqHmn4A11xi13MncY9rSZvWwqr4Ry-qXZ8VxcqW_4eddfMVhknQ7Jg0rzX9YGYH5wjUbJDkV

LESSON 3 – Corporate Social Responsibility (CRS)	Date 29/04/2020
UNIT 1 – Corporate communication	
Content	The unit provides a definition of corporate communication in comparison with business communication. There will be outline concept like identity, responsibility, reputation, and so on.
Tags	Reputation, identity, goodwill,
Assignment n.	Quiz n.

UNIT 2 – Social responsibility	
Content	Unit defines Corporate Social Responsibility, its relevance in contemporary corporate communication focusing on CSR mean
Tags:	CSR, communication, ethics
Assignment n.	Quiz n.
UNIT 3 – CSR campaigns (classroom activity)	
Content	Reading activity on the lesson issue.
Tags:	Case study, CSR
Assignment n.	Quiz n.
Peer assessment	

PEDAGOGICAL TOOLS	
Study materials	Course slides and suggestion readings (open-access or available on-line) https://link.springer.com/content/pdf/10.1007/s10551-010-0731-7.pdf

LESSON 4 – Consumers & Communication	Date 06/05/2020
UNIT 1 – Introduction to the sociology of consumption	
Content	In the unit are provided basics of sociology of consumption focusing on some approached and theory.

Tags	Consumption, values, meaning,
Assignment n.	Quiz n.
UNIT 2 – Proactive, smart & critical: the "prosumer"	
Content	Unit describes new consumers and the importance of ICT and ethics in its consumption behaviors.
Tags:	ICT, fair trade, ethics
Assignment n.	Quiz n.
UNIT 3 – Prosumers and the energy issues (classroom activity)	
Content	Reading activity on the lesson issue.
Tags:	Byucott, voice & exit strategies
Assignment n.	Quiz n.
Peer assessment	

PEDAGOGICAL TOOLS	
Study materials	Course slides and suggestion readings (open-access or available on-line) https://www.mdpi.com/1996-1073/11/10/2528/pdf

LESSON 5 – Communication plan	Date 13/05/2020
UNIT 1 – Defining a communicative plan	
Content	Units shows the steps to define a communication plan and its means.

Tags	Planning, below-the-line means, advertise
Assignment n.	Quiz n.
Peer assessment	
UNIT 2 – Communication activities and means	
Content	Unit presents some communication means for an effective corporate communication.
Assignment n.	Quiz n.
UNIT 3 – Defining strategic communication (classroom activity)	
Content	Reading activity on the lesson issue.
Tags:	
Assignment n.	Quiz n.
Peer assessment	

PEDAGOGICAL TOOLS	
Study materials	Course slides and suggestion readings (open-access or available on-line) https://www.tandfonline.com/doi/full/10.1080/15531180701285244?casa_token=l3s2Q97JB9sAAAAA:iFO0M9KcCVorhGIp6auwkalQrITu1rjp9fBdYlBNukK1dW4X3AVfZ7TvYMdSTdbx3onvO6T0kLeZKg

LESSON 6 – Communication of Energy companies	Date 20/05/2020

UNIT 1 – Energy issue and renewables	
Content	Unit proposes a short insight on the energy issues and the energy market to define the context of energy utility communication.
Tags	Renewables, energy market, liberalization
Assignment n.	Quiz n.
Peer assessment	
UNIT 2 – Energy consumption and communication	
Content	Units show the main dimensions involved in the costumers decision to sign a provision energy contracts or small energy plants for self-production.
Tags:	Decision process, the “value” of energy
Assignment n.	Quiz n.
Peer assessment	
UNIT 3 – Energy company campaigns (classroom activity)	
Content	Reading activity on the lesson issue.
Tags:	
Assignment n.	Quiz n.
Peer assessment	

PEDAGOGICAL TOOLS	

Study materials	Reading activity on the lesson issue. https://www.emerald.com/insight/content/doi/10.1108/02686900310469925/full/pdf?title=stakeholder-communication-and-the-internet-in-uk-electricity-companies

2.4.2.11 Learning Material: A holistic approach for Energy Transition: territory, networks, and sustainability

Course Title	A holistic approach for Energy Transition: territory, networks, and sustainability
To be published April, 2020 Closing date May 2020	Coauthors: Prof. Anna Maria Zaccaria Prof. Fabio Corbisiero Dr. Ilaria Marotta
Overview	This course, promoting a holistic approach, is aimed to reach all individuals interested in the topic and willing to promote sustainable participatory planning of Energy Transition. The course focuses on the socio-territorial and environmental perspective in order to understand Energy Transition as a social construction process. The first two modules of the course are dedicated to clarify the concept of ET and to understand it as a social construction process in order to a territorial, social and environmental perspective. In the third and fourth modules, we will address the issue of the Sustainable Participatory Planning of Energy Transition and its implications in terms of cooperation/conflict. Finally, in the last two modules the participants will acquire basic notions of the theoretical and methodological approach of the Social Network Analysis, specifically in order to identify: a) network as a tool of sustainable participatory planning; b) role, skills and weight of the central actors in the social construction of ET.

Learning Objectives and Outcomes	Understand the social construction of Energy Transition in order to: 1 – territorial perspective; 2- social perspective; 3 - an environmental perspective · Understand the concept of sustainability and of participatory planning. · Understand the implications in terms of cooperation/conflict using case studies. · Acquire basic notions of theoretical and methodological approach of the Social Network Analysis, specifically in order to identify: · Network as a tool of participatory planning; · Role, skills and weight of the brokers.

LESSON 1 : Introduction to Energy Transition.	Date 15/04/2020
Learning Objectives:	Understand the implications of Energy Transition in order to a territorial and environmental perspective.
UNIT 1	What is Energy Transition?
UNIT 2	Energy and social change
UNIT 3	Social acceptability of the renewable energies
PEDAGOGICAL TOOLS	
Study materials: lecture slides and suggested readings (book chapters, research papers, scientific essays, ecc.)	
Assessment: Multiple-choice test.	
Blog post Dissemination/Communication: YES	
Virtual classroom: NO	

Conversation tool: YES

LESSON 2: The social construction of Energy Transition	Date 22/04/2020
Learning Objectives:	Understand the "social construction" of Energy Transition in order to cultures, practices, and perceptions.
UNIT 1:	Nimby Syndrome: renewable energy and risk perception
UNIT 2:	Energy and cultural practices
UNIT 3:	Meaning and implication of Sustainable planning of Energy Transition

PEDAGOGICAL TOOLS
Study materials: lecture slides and suggested readings (book chapters, research papers, scientific essays, ecc.)
Assessment: Multiple-choice test.
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 3: Meaning and implication of Sustainable planning of Energy Transition	Date 29/04/2020
Learning Objectives:	Understand the concept of sustainability and participatory planning.

UNIT 1:	The concept of sustainability
UNIT 2:	Tools of participatory planning
UNIT 3:	Case studies

PEDAGOGICAL TOOLS
Study materials: lecture slides and suggested readings (book chapters, research papers, scientific essay, case studies)
Assessment: Multiple-choice test.
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

LESSON 4 : Cooperation/conflict: implications	Date 06/05/2020
Learning Objectives:	Understand the implications of Energy Transition in terms of cooperation/conflict using case studies.
UNIT 1 TITLE:	Energy communities
UNIT 2 TITLE:	Conflicts about renewable energy. The Italian case

PEDAGOGICAL TOOLS
Study materials: lecture slides and suggested readings (book chapters, research papers, scientific essay, case studies)
Assessment: Multiple-choice test.
Blog post Dissemination/Communication: YES

Virtual classroom: NO
Conversation tool: YES

LESSON 5 : Basic Concepts and tools in Social Network Analysis	Date 13/05/2020
Learning Objectives:	To acquire basic notions of the theoretical and methodological approach of the Social Network Analysis, specifically in order to identify social networks as a tool of cooperation/conflict dynamics.
UNIT 1:	Basic concepts in SNA
UNIT 2:	Methodology and tools in SNA: centrality index
PEDAGOGICAL TOOLS	
Study materials: lecture slides and suggested readings (book chapters, research papers, scientific essay, case studies)	
Assessment: Multiple-choice test.	
Blog post Dissemination/Communication: YES	
Virtual classroom: NO	
Conversation tool: YES	

LESSON 6: Governance networks: actors, skills and dynamics	Date 20/05/2020
Learning Objectives:	Acquire basic notions of the theoretical and methodological approach of the Social Network Analysis, specifically in order to identify the role, skills and weight of the brokers.
UNIT 1:	Multilevel Governance

UNIT 2:	Role, skills, and weight of the brokers
UNIT 3:	Network as resource

PEDAGOGICAL TOOLS
Study materials: lecture slides and suggested readings (book chapters, research papers, scientific essay, case studies)
Assessment: Multiple-choice test.
Blog post Dissemination/Communication: YES
Virtual classroom: NO
Conversation tool: YES

2.4.2.12 Learning Material: Hydrogen as Energy Vector

Course Title	Hydrogen as Energy Vector
To be publish 21/ 04 / 2020 Closing date 11 / 06 / 2020	Coauthors: Carlos Sánchez, Elisa Peñalvo, Paloma Zúñiga
Overview	This course provides a detailed description of the hydrogen technologies when it is used as energy carrier (electrolysis, storage and fuel cell technologies).
Learning Objectives	Technological knowledge of the systems involved in the conversion of electricity to hydrogen and hydrogen to electricity.
Outcomes	Understanding industrial electrolysis processes Capacity of sizing an electrolyzer Capacity of sizing the storage system Understanding electricity generation through the use of fuel cells

	Ability to select and size a fuel cell.

LESSON 1 Hydrogen overview	Date 21 / April / 2020
Learning Objectives	To know the history, properties, applications and challenges of hydrogen.
UNIT 1 : Hydrogen overview	
Content	Hydrogen introduction. Hydrogen properties. Overview of hydrogen use. Hydrogen economy. Future challenges and opportunities.
Tags:	Hydrogen properties, hydrogen applications, hydrogen challenges
Assignment	Quiz number 1.
Peer assessment	

PEDAGOGICAL TOOLS
Study materials, Power point presentations, Video presentation.
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 2 Hydrogen production ways	Date 23 / April / 2020

Learning Objectives	To know the different ways to produce hydrogen apart from those based on electrolysis.
UNIT 1 ; Hydrogen production from fossil fuels	
Content	Hydrogen production from natural gas (H2O reforming, CO2 reforming, Partial oxidation, metallic oxide reduction, thermal or thermocatalytic craking), carbon, petroleum, alcohols (methanol, ethanol, etc…)
Tags:	Hydrogen from natural gas. Hydrogen from carbon. Hydrogen from petroleum. Hydrogen from alcohols.
Assignment	Quiz number 2.
UNIT 2 : Hydrogen production from biological methods	
Content	Hydrogen production from biomass (gasification, pirolysis), biophotolysis, fermentation.
Tags:	Hydrogen from biomass. Hydrogen from biophotolysis. Hydrogen from fermentation.
Assignment	Quiz number 3
UNIT 3 : Hydrogen production from water by means thermolysis.	
Content	Medium temperature thermolysis, high temperature thermolysis, direct thermal decomposition of water
Tags:	Hydrogen from thermolysis.
Assignment	Quiz number 4

PEDAGOGICAL TOOLS
Study materials Power point Presentations Video presentation.

LESSON 3 Hydrogen production by electrolysis technology	Date 30 / April / 2020
Learning Objectives	To know the electrochemical processes to produce hydrogen from water using electricity. To know the two main technologies used in electrolysis: alkaline and PEM
UNIT 1 : Electrolysis principles	
Content	Basic electrochemical processes. Effect of temperature. High temperature electrolysis. High pressure electrolysis.
Tags:	Electrochemical processes in electrolysis
Assignment	Quiz number 5.
UNIT 2 : Alkaline electrolysis technology.	
Content	Basics of alkaline electrolysis. Cell structure (electrolyte, electrodes, diaphragm or membranes). Market of alkaline electrolysers.
Tags:	Alkaline electrolysis
Assignment number 1: Selection of an alkaline electrolyzer for a particular application.	Quiz number 6

Peer assessment	
UNIT 3 : PEM electrolysis technology	
Content	Concept of solid polymer electrolyte cell. Description of unit PEM cells. Structure of cell (electrodes, membrane, current-gas distributors, bipolar plates). Stack performance. Market of PEM electrolysers
Tags:	PEM electrolysis
Assignment number 2: Selection of a PEM electrolyzer for a particular application.	Quiz number 7
UNIT 4 Demonstration of an alkaline electrolyzer working in the LabDER laboratory	
Content	Taking advantage of the equipment installed in the Labder laboratory, a practical demonstration of the operation of an alkaline electrolyser will be carried out. A description of the whole hydrogen production system shall be made, and the measurement parameters shall be shown.
Tags:	Practical electrolysis
Assignment	Quiz number 8

PEDAGOGICAL TOOLS
Study materials, Power point presentations, Video presentation.
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 4 Hydrogen storage technology	Date 14 / May / 2020
Learning Objectives	To know the different methods to store hydrogen. To know the advantages and disadvantages of each method. To know all the elements involved in a hydrogen storage system.
UNIT 1 Hydrogen storage technologies	
Content	Liquid hydrogen storage. Metal hydrides storage. Gaseous hydrogen storage. Compression of hydrogen. Hydrogen transport.
Tags:	Hydrogen storage
Assignment	Quiz number 9.
Peer assessment	No
PEDAGOGICAL TOOLS	
Study materials, Power point presentations, Video presentation.	

LESSON 5 Fuel Cell technology	Date 19 / May /2020
Learning Objectives	To know the characteristics of each type of fuel cell. There are six types of fuel cell classified depending on the electrolyte used to perform the electrochemical reaction.
UNIT 1 : Introduction to fuel cell technology.	
Content	Introduction to fuel cell operation. How electrical energy is generated. The general structure of fuel cells.

Tags:	Fuel Cell technology
Assignment	Quiz number 10.
UNIT 2 : Low temperature fuel cells.	
Content	Alkaline Fuel Cells. Proton Exchange Membrane Fuel Cells. Direct Methanol Fuel Cells.
Tags:	Low temperature fuel cells
Assignment	Quiz number 11
UNIT 3 : Medium and High temperature Fuel Cells	
Content	Molten Carbonate Fuel Cells. Solid Oxide Fuel Cells. Phosphoric Acid Fuel Cells.
Tags:	Medium temperature and High temperature fuel cell
Assignment	Quiz number 12

PEDAGOGICAL TOOLS
Study materials Power point presentations. Video presentation.

LESSON 6 Fuel Cell applications	Date 26 / May / 2020
Learning Objectives	To know the particular use of each type of fuel cell currently.
UNIT 1 : Stationary applications of fuel cells	

Content	Characteristics of stationary applications. Examples of stationary applications using different types of fuel cell. Numbers of the stationary applications in the world.
Tags:	Fuel cell stationary applications
Assignment	Quiz number 13.
UNIT 2 : Non stationary applications of Fuel Cells	
Content	Characteristics of mobile applications. Examples of mobile applications (transport). Numbers of the non-stationary applications in the world.
Tags:	Fuel cell mobile applications
Assignment	Quiz number 14
Peer assessment	

PEDAGOGICAL TOOLS
Study materials Power point presentations. Video presentation.

LESSON 7 Voltage generation in a fuel cell	Date 2 / June / 2020
Learning Objectives	To know what the normal operating state of a fuel cell is and also identify abnormal operation conditions. To know the internal processes which occur in the fuel cell when power is delivered.
UNIT 1 : Open circuit voltage generation in the electrochemical reaction	

Content	Based on the electrochemical equations of the H2/O2 reaction, the reversible voltage of a fuel cell is calculated.
Tags:	Fuel cell reversible voltage
Assignment number 3: Mathematical model of the fuel cell voltage generation depending on the temperature	Quiz number 14.
Peer assessment	number 1
UNIT 2 Irreversibility in fuel cell voltage generation	
Content	From the reversible voltage, all the electrochemical irreversibility occuring in the different elements of a fuel cell are presented.
Tags:	Voltage irreversibility
Assignment number 4: Mathematical model of the fuel cell voltage generation irreversibility. Fuel cell modelling.	Quiz number 15
Peer assessment	number 2

UNIT 3 : Methods to determine irreversibility	
Content	Different methods to experimentally determine the irreversibility of the fuel cell behavior are presented.
Tags:	Irreversibility methods
Assignment	Quiz number 16
PEDAGOGICAL TOOLS	
Study materials	

Power point presentations. Video presentation.

LESSON 8 Polymer Membrane Electrolyte operating	Date 4 / June / 2020
Learning Objectives	To know in detail all the elements which take part in a PEMFC. To know the water management problem. To know the heat management problem.
UNIT 1 : Elements of a PEM Fuel Cell	
Content	Membrane Electrode Assembly (MEA) description. Bipolar plates description.
Tags:	MEA. Bipolar plates.
Assignment	Quiz number 17.
UNIT 2 : Water and heat management on a PEMFC	
Content	Describe all the techniques to produce water in a PEMFC and all the methods to extract it from inside, depending on the fuel cell temperature. The problem of the generated heat.
Tags:	Water management. Heat management.
Assignment	Quiz number 18

PEDAGOGICAL TOOLS
Study materials Power point presentations. Video presentation.

LESSON 9 Hydrogen energy storage dimensioning	Date 9 / June / 2020
Learning Objectives	To dimension a hydrogen energy storage system HESS.
UNIT 1 : Dimensioning the hydrogen production system	
Content	Using renewable energies (solar photovoltaic) as primary energy source, dimensioning the electrolyser and the hydrogen storage will carry out in order to store the surplus of the produced energy.
Tags:	Electrolyser dimensioning Hydrogen storage dimensioning
Assignment number 5: Dimensioning the electrolyzer and compressed hydrogen storage for an autonomous solar photovoltaic system	Quiz
UNIT 2 : Dimensioning the fuel cell and power electronics	
Content	When energy from the solar photovoltaic system is not enough, power from hydrogen is needed. Power electronics inverter should be sizing in order to inject the needed energy
Tags:	Fuel Cell dimensioning Power inverter sizing
Assignment number 6: Dimensioning the fuel cell and power electronics inverter for an autonomous solar photovoltaic system.	Quiz

PEDAGOGICAL TOOLS

Study materials, Power point presentations, Video presentation
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

2.4.2.13 Learning Material: Train the trainer

Course Title	TRAIN THE TRAINER
Coauthors:	Nikos Agiotis, Stavroula Bertzouani, Marios Vlachos
To be published 15/4/2020 Closing date 10/01/2021	
Overview	This course targets to improve the trainers capabilities to engage their audience.
Learning Objectives	By the end of the "Train the Trainer" session participants will be able to teach adults in a more effective way.
Outcomes	By the end of the "Train the Trainer" session participants will be able to: ● discover how adults learn and what motivates adult learners ● provide constructive and effective feedback to adult learners ● design training sessions appropriate to the learner, resources and desired learning outcomes ● prepare and deliver training sessions ● practice proven training techniques ● develop effective communication ● manage and engage different audiences ● improve standards of teaching and training by means of reflective practice

LESSON 1 TITLE	TRAIN THE TRAINER
	Date 15/04/2020
Learning Objectives	By the end of the "Train the Trainer" session participants will be able to: ● discover how adults learn and what motivates adult learners ● design training sessions appropriate to the learner, resources and desired learning outcomes ● prepare and deliver training sessions

UNIT 1 : GENERAL PRINCIPLES OF ADULT TRAINING	
Content	Important Principles to trainees Clarification of learning goals Encouragement for Active participation
Tags:	learning goals, participants needs, active participation, educational and cooperative spirit, engagement
Assignment n.	Quiz n. 1
Peer assessment	
UNIT 2: ADULT TRAINING FUNDAMENTALS	
Content	Definition of adult training Learning Stages Purpose of adult training 4 phases of learning
Tags:	learning stages, purpose, knowledge, skills, attitudes & behavior, 4 phases of learning, explanation, demonstration, practice & imitation, consolidation
Assignment n.	Quiz n. 2
UNIT 3: TRAINING AIMS AND OBJECTIVES	
Content	Elements of effective training Creating an effective training environment
Tags:	training aims, knowledge, competencies, mindset, effective training
Assignment n.	Quiz n. 3
Peer assessment	
UNIT 4 : TRAINING STRUCTURE	
Content	Developing a learning objective Organizing and Structuring Content
Tags:	trainee characteristics, training aims, training content, techniques and tools, evaluation
Assignment n.	Quiz n. 4
LESSON 2	TRAINING EXECUTION

	Date 15/04/2020_____/_____/_____
Learning Objectives	By the end of the "Train the Trainer" session participants will be able to: ● provide constructive and effective feedback to adult learners ● practice proven training techniques ● develop effective communication ● manage and engage different audiences ● improve standards of teaching and training by means of reflective practice
UNIT 1 : Training Execution	
Content	Microteaching Review and feedback
Tags:	Microteaching, preparation, review and feedback
Assignment n.	Quiz n. 5
Peer assessment	Microteaching
UNIT 2: AUDIENCE COMMUNICATION	
Content	Personality types Communication process Communication barriers Communication skills
Tags:	Personality types, communication process, sensory receptors, principle of communication, barriers, communication skills, vocabulary & language, questions, trust, value, empathy, breakdown, rapport
Assignment n.	Quiz n. 6
UNIT 3 : AUDIENCE MANAGEMENT	
Content	Getting participants involved Handling questions Providing feedback
Tags:	
Assignment n.	Quiz n. 7
Peer assessment	preparation, participation, questions, challenges, feedback

PEDAGOGICAL TOOLS
Study materials: Presentation & Quiz
Blog post Dissemination/Communication: No
Virtual classroom: YES
Conversation tool: e-mail exchange

2.4.2.14 Learning Material: New Material for solar Cells Applications

Course Title	New Materials for solar cells applications
To be published 23/3/2020 Closing date 25/5/2020	Coauthors: Dr. Theodore Ganetsos – Professor Dr. Kyriaki Kiskira – Postdoc Scientist
Overview	The objective of this course is to provide an insight into the fundamentals of solar cells and describe the manufacturing processes of different types of photovoltaics (PV) [1]. Throughout the course, students will learn the physical principles of solar irradiation and solar cell operation. Emerging concepts of polymer, hybrid and quantum-dot-based solar cells will be described including device physics, manufacturing and technological development.
Learning Objectives	• Introduction in new materials for solar cells applications • Solar Energy • Power Generation from solar cells • Operation and Production of solar cells • Thin films and polymers • Material characterization and Optical measurements • Materials properties and characterization and Solar Energy Spectrum and Band Gap Tuning • Case studies, Laboratory – experimental work
Outcomes	• Recall the history of Solar Cells • Identify the importance of Solar Energy • Define the Power generation from solar cells • Describe Solar cells technology • Recall the operation of solar cells • Describe the Production of solar cells

	• List thin films solar cells • Describe the polymer solar cells • Define Methodology and Importance of materials characterization • List the Characterization techniques • Describe the optical measurements • Identify materials properties and characterization • Define implement Solar Energy Spectrum and the Necessity of Band Gap Tuning • Recognize the relationship of the profession of Industrial Design and Production Engineering and the renewable resources of energy and their interdependence. • Ability to apply that knowledge in his/her business life. •

LESSON 1: Introduction in new materials for solar cells applications	Date 23/3/2020
Learning Objectives	Recall the history of Solar Cells
UNIT 1 : Introduction - History of Solar Cells	
Content	Be aware of the History of solar cell, Basic terminology and definitions in the fields of solar cells, new materials for solar cells and applications, Overview of solar cells applications using slides, videos and practice exercises.
Assignment n. 1.1	Quiz n. 1.1.1-1.1.4
Peer assessment	2

PEDAGOGICAL TOOLS
Study materials reading – videos and exercises
Blog post Dissemination/Communication yes
Virtual classroom - using e-class platform

Conversation tool - Yes

LESSON 2: Solar Energy	Date 30/3/2020
Learning Objectives	Identify the importance of Solar Energy
UNIT 1 : The importance of Solar Energy	
Content	Introduction to the fundamentals of solar energy, why solar energy, Solar panel system installations, Key components in a basic photovoltaic (solar panel) system, explanation of the function of each component in the system, comparison of solar energy to other energy resources and understand the importance of solar energy using slides, videos and practice exercises [2, 3].
Assignment n. 2.1	Quiz n. 2.1.1-2.1.4
Peer assessment	2

PEDAGOGICAL TOOLS
Study materials reading – videos and exercises
Blog post Dissemination/Communication yes
Virtual classroom - using e-class platform
Conversation tool - Yes

LESSON 3: Power Generation from solar cells	Date 6/4/2020
Learning Objectives	-Define the Power generation from solar cells -Describe Solar cells technology -Recall the operation of solar cells

UNIT 1 : Power generation from solar cells	
Content	Understanding of solar cell technologies, knowledge on the power generation from solar cells - explanation of how solar panels, or photovoltaics (PV for short), convert sunlight to electricity using slides, videos and practice exercises [4].
Assignment n. 3.1	Quiz n. 3.1.1-3.1.4
Peer assessment	2
UNIT 2 : Calculation of the electrical demand	
Content	Calculation of the electrical demand of a building, how to reduce the overall demand, and then how to design a solar panel system that can meet that annual demand at a given location using slides, videos and practice exercises.
Peer assessment	2

LESSON 4: Operation and production of solar cell	Date 27/4/2020
Learning Objectives	-Describe the Production of solar cells -Recall the operation of solar cells
UNIT 1 : Operation of solar cells	
Content	Description of the operation of solar cells, Efficiency of solar cells. Acquire knowledge on the operation of solar cells, using slides, videos and practice exercises.
Assignment n. 4.1	Quiz n. 4.1.1-4.1.4
Peer assessment	2
UNIT 2 : Production of solar cells	

Content	Introduction in the Production of solar cell, raw materials, knowledge on the use of silicon for the production of solar cell, the manufacturing process (Purifying the silicon, Making single crystal silicon, Making silicon wafers, Doping, Placing electrical contacts, The anti-reflective coating, Encapsulating the cell, quality control, new materials, future, case studies. Market situation and perspectives, using slides, videos and practice exercises [5-7].
Assignment n. 4.2	Quiz n. 4.2.1-4.2.4
Peer assessment	2

PEDAGOGICAL TOOLS
Study materials reading – videos and exercises
Blog post Dissemination/Communication yes
Virtual classroom - using eclass platform

LESSON 5: Thin films and polymers	Date 4/5/2020
Learning Objectives	-List thin films solar cells -Describe the polymer solar cells
UNIT 1 : Thin films solar cells	
Content	Acquire knowledge on the use thin-film solar cells, a potential solution to the significant problem associated with silicon solar cells: namely energy payback time, knowledge on the use of Thin-film solar cells using slides, videos and practice exercises [8-12].
Assignment n. 5.1	Quiz n. 5.1.1-5.1.5

Peer assessment	2
UNIT 2 : Polymer solar cells	
Content	-New emerging technologies, polymer solar cells, examples of a third-generation solar cell technology, pros and cons of this technology, knowledge on the use of Polymer solar cells -Selection of solar cell technologies and comparing all the different solar cell technologies. -Case studies and examples.
Assignment n. 5.2	Quiz n. 5.2.1-5.2.5
Peer assessment	2

LESSON 6: Material Characterization	Date 11/5/2020
Learning Objectives	-Define Methodology and Importance of materials characterization -List the Characterization techniques -Describe the optical measurements
UNIT 1: Methodology and Importance of materials characterization	
Content	Description of the characterization techniques, the most important techniques used to characterize and study the properties of traditional and advanced materials (X-ray diffraction techniques, thermal analysis measurements, vibrational spectroscopy techniques as well as basic measurements of mechanical properties of materials such as strength and hardness measurements) in-depth understanding of these techniques, the preparation of measurement samples, the performance of measurements and the analysis of measurements, using slides, videos, practice exercises and laboratory training [13-16].
Assignment n. 6	Quiz n. 6.1.1-6.1.2
Peer assessment	2

UNIT 2 **:** Optical measurements	
Content	Optical properties of solar cells, description of the optical measurements, design and perform of optical measurement using slides, videos, practice exercises and laboratory training. [17-19].
Assignment n. 6.2	Quiz n. 6.2.1-6.2.2
Peer assessment	2
PEDAGOGICAL TOOLS	
Study materials reading – videos and exercises	
Blog post Dissemination/Communication yes	
Virtual classroom - using e-class platform	

LESSON 7: Laboratory – experimental work and Case Studies	Date 18/5/2020
Learning Objectives	- Laboratory – experimental work - Recognize the relationship of the profession of Industrial Design and Production Engineering and the renewable resources of energy and their interdependence. - Ability to apply that knowledge in his/her business life.
UNIT 1 : Characterization techniques and optical measurements	
Content	Be able to apply techniques for characterization and optical measurements using slides, videos and practice exercises.
Assignment n. 7.1	Quiz n. 7.1.1-7.1.2
Peer assessment	2
UNIT 2 : Case Studies	
Content	- Case studies on solar cell selection based on the total cost of ownership.

	- Case studies on new materials for solar cells based on the total cost and environmental impact. - Case studies on selecting raw materials based on environmental impact and economic benefits. - Evaluation of the costs and benefits in terms of energy and environmental impact for selecting the different source of materials for products or services. - Estimations of carbon fees and production cost under the different selection of raw materials and solar cells.
Assignment n. 7.2	Quiz n.7.2.1-7.2.2
Peer assessment	2
PEDAGOGICAL TOOLS	
Study materials reading – videos and exercises	
Blog post Dissemination/Communication yes	
Virtual classroom - using e-class platform	

LESSON 8: Material Properties and characterization	Date 25/5/2020
Learning Objectives	- Identify materials properties and characterization - Define implement Solar Energy Spectrum and the Necessity of Band Gap Tuning
UNIT 1: Materials properties and characterization	
Content	Identification of material properties, understanding of material properties, mechanical properties of the materials, the revelation of the microstructure, the chemical composition and their morphology, the formulation and characterization of the final product, modeling a solar cell, knowledge of solar energy conversion by semiconductors,

	case studies for product improvement and new designs. Be able to design and perform band gap measurements [20-22].
Assignment n. 8.1	Quiz n.8.1.1-8.1.2
Peer assessment	2
UNIT 2 : Experimental Measurements	
Content	a. Perform experiments to measure Band Gap of ZnO Films Using UV-Vis Absorption Spectra (CBL) b. Preparation of Zn1-xMxO Films c. Analysis of Results
Assignment n. 8.2	Quiz n.8.2.1-8.2.2
Peer assessment	2

PEDAGOGICAL TOOLS
Study materials reading – videos and exercises
Blog post Dissemination/Communication yes
Virtual classroom - using e-class platform

2.4.2.15 Learning Material: Energy and Environment

Course Title	Energy and Environment
To be published 02/04/2020 Closing date 18/06/2020	Dr. Psomopoulos Constantinos – Professor UWA
Overview	● Energy generation and environment, greenhouse gasses emissions and climate change. ● Energy efficiency and energy saving: Introduction to energy efficiency in products and systems.

	● Energy and environmental policies and their interdependence. ● The European Directives Energy Efficiency, Eco-label, Energy-label, Eco-design, RoHs, EMAS, and their application to equipment and various industrial devices ● The life cycle analysis in the production and operation of the equipment ● End-of-life of waste electrical, electronic and industrial equipment. Legislation ● Designing systems in accordance with the instructions for EcoDesign.
Learning Objectives	The MOOC aims to give an overview and the knowledge for the interconnection of the production and consumption of energy with the environment under the context of the energy transition. In particular, using a case-based approach, and tools' analysis, the course will start with the basic and core presentation of the impact of the energy generation and consumption to the environment on terms of resources consumption, gasses emission, impact on land and water. After examples of energy and environmental performance indicators calculations and presentation of different approaches and case studies, the implementation of energy efficiency and RES in the environment is evaluated. Typical approaches involving consumer behavior and products selection is included. Basic aspects related to evaluate the environmental impact of products, their end-of-life and basic principles of eco-design are also presented.
Outcomes	Once students have completed the course, they will be able to: · Relate the energy generation and consumption with the environment. · Recognize the impact to the local and global climate that the energy generation and consumption have. · Classify what is Renewable and non-renewable source of energy. · Describe the energy efficiency, ecolabel EU legislation · Select energy efficiency and energy savings actions in everyday life and especially in energy consumption, at appliance level, house level, enterprise level, country level. · Identify and select equipment and devices based on energy efficiency criterion. Ability to perform the studies and work and to assess their results considering this parameter.

	· Ability to use the principles of ecological design (Eco-Design) and environmental legislation regulations that define the design, operation and the end of life cycle of electrical equipment and installations, in his/her professional activity. · Describe the legislation on the end of life treatment and recycling potential of waste electrotechnical equipment, as a key activity related to energy consumption and environment · Ability to apply that knowledge in his/her business life.

LESSON 1: Introduction in energy and environment	Date: April 2, 2020
Learning Objectives	Students will learn the basic terminology and definitions used in energy, environment and climate change. In addition, they will learn how to identify renewable and non-renewable energy sources.
UNIT 1: Basic Terminology	
Content	Basic terminology and definitions in the fields of energy and environment, and climate change.
Tags:	Energy intensity. Energy production. Energy efficiency. Energy Savings. Environment. Environmental Impact.
Assignment n.: 1	Quiz n.: 1.1
Peer assessment	No
Unit 2: Classification and availability of energy sources	
Content	Classification and availability of energy sources. Overview of renewable and non-renewable energy technologies.

Tags:	Fossil fuels. Nuclear energy. Renewables.
Assignment n.: 1	Quiz n.: 1
UNIT 3: Environmental Impact of energy generation and usage.	
Content	Environmental impact (greenhouse gas emissions, water impact, land impact) of energy sources.
Tags:	Greenhouse gas emissions. Environmental impact. Land use.
Assignment n.: 1	Quiz n.: 1.1

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises

LESSON 2: Energy, Environment and Climate Change	Date: April 9, 2020
Learning Objectives	The students will learn the connection of the energy production and consumption with the environment and climate change through the greenhouse phenomenon.
UNIT 1: Greenhouse Phenomenon	
Content	Solar geometry, solar radiation and greenhouse phenomenon: engineering basic concepts. How to determine the impact to the greenhouse phenomenon of different gasses, and the global warming potential.
Tags:	Solar geometry. Global Warming Potential. Greenhouse effect. Climate change. Energy Security.
Assignment n.: 1	Quiz n.: 1.1
Peer assessment	No
UNIT 2: Impact of Climate Change	

Content	Greenhouse effect on climate change. Impact of climate change in energy usage and energy security. Impact of climate change on the planet and weather.
Tags:	Climate change. Energy Security. Impact on climate. Extreme weather conditions.
Assignment n.: 1	Quiz n.: 1.1

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises

LESSON 3: Energy efficiency and energy saving: Introduction to energy efficiency in products and systems.	Date: April 30, 2020
Learning Objectives	At the end of the lesson, students will be able to: Understand the importance of energy efficiency and savings in protecting the environment; Understand the importance of the energy savings and energy efficiency in selection of equipment or services and their economic aspects; Identify and use the economic and environmental approach to select and operate equipment or systems.
UNIT 1: Energy Savings and Energy Efficiency	
Content	Energy savings. Definition and actions. Role of human behavior in energy savings. Energy saving measures. Energy Efficiency and energy efficient products. The role of energy savings and efficiency in reducing the impact to the environment.
Tags:	Energy Efficiency. Energy Savings. Energy rates. Carbon fees.
Assignment n.: 1	Quiz n.: 1.2
Peer assessment	No

UNIT 2: Economics of energy savings and energy efficiency	
Content	Economic benefits of energy savings at family, district, regional or country scale. Economic benefits at business level. Case studies. Market situation and perspectives.
Tags:	Energy rates. Carbon fees.
Assignment n.: 1	Quiz n.: 1.2

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises

LESSON 4: Energy and Environmental Policies and their interconnection	Date: May 7, 2020
Learning Objectives	At the end of the lesson, students will be able to: · Understand the implications and impacts of energy policies to the environment at local, regional and global scale; · Evaluate the role of environmental legislation in energy demand and consumption; · Understand the critical role of balance between energy and environment and the importance of policy instruments.
UNIT 1: Energy policies and environment	
Content	Classification and technical / economical characteristics of energy related policies. The role of energy efficiency and renewables in energy policies. Environmental impact of different policies. Economic impact.
Tags:	Energy Efficiency policies. Renewables policies. Energy mix. Environmental impact of energy policies.
Assignment n.: 2	Quiz n.: 2.1
Peer assessment	No

Unit 2: Environmental policies related to energy	.
Content	Environmental protection and energy. Policies related to GHG emissions. Industry policies for environmental protection affecting energy. Economic impact to energy from environmental legislation.
Tags:	Environmental protection. Carbon tax. GHG emissions reduction policies.
Assignment n.: 2	Quiz n.: 2.1

PEDAGOGICAL TOOLS	
Study materials, Presentations, reading – videos and exercises	
LESSON 5: European Directives Energy Efficiency, EPBD, Eco-label, Energy-label, RoHS, EMAS	Date: May 14, 2020
Learning Objectives	At the end of the lesson, students will be able to: · Understand and use of the directives; · Evaluate their impact on specific products or systems; · Calculate specific indicators related to them.
UNIT 1: Energy Efficiency Directive	
Content	Energy Efficiency Directive. Calculation of Energy efficiency indicators. Fields of implementation. Expected results and benefits.
Tags:	Energy Efficiency Directive. Energy indicators
Assignment n.: 3	Quiz n.: 3.1
Peer assessment	No
Unit 2: Energy-label, EPBD	
Content	EU Energy Label. Details and implementation. Products under Energy Label. EPBD and building's efficiency. Case studies. Market situation and perspectives.

Tags:	Energy Label. EPBD.
Assignment n.: 3	Quiz n.: 3.1
Peer assessment	No
Unit 3: RoHS, Eco-label, EMAS	
Content	RoHS Directive. Fields of implementation and environmental impact. Eco-Label in products. Description, fields of implementation in the energy related fields and impacts. EMAS. Description, fields of implementation and its impact on energy and environment. Case studies. Market situation and perspectives.
Tags:	RoHS. Eco-Label. EMAS.
Assignment n.: 3	Quiz n.: 3.1

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises

LESSON 6: End-of-life of waste electrical, electronic and industrial equipment.	Date: May 21, 2020
Learning Objectives	At the end of the lesson, students will be able to: · Understand the importance of end-of-life approaches in electrical, electronic and other energy consuming equipment; · Assess the impact to the environment from the end-of-life approaches; · Minimize the impact from the end-of-life of equipment and products.
UNIT 1: Legislation	
Content	WEEE Directive. Waste Directive. Presentation and fields of implementation.
Tags:	WEEE Directive. Waste Directive

Assignment n.: 4	Quiz n.: 4.1
Peer assessment	No
Unit 2: End-of-life of waste electrical, electronic and industrial equipment	
Content	End-of-life treatment of waste electrical, electronic and industrial equipment Technical and economic assessment of basic approaches: criteria and tools. Energy consumption during end of life. Case studies. Market situation and perspectives.
Tags:	Raw materials. Waste Electrical and electronic equipment. Recycling.
Assignment n.: 4	Quiz n.: 4.1
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises

LESSON 7: Waste as resources.	Date: May 28, 2020
Learning Objectives	At the end of the lesson, students will be able to: · Understand the importance of waste as resources or raw materials for different processes; · The positive impact from the environment from going from wastes to resources. · Benefits of Recycling
UNIT 1: Wastes as resources	
Content	Valuable materials in different waste streams. Waste biomass as energy resource. Recyclables and non-recyclable materials. Waste derived fuels as alternative sources of energy.
Tags:	Wastes. Resources. Recycling, waste derived fuels.

Assignment n.: 4	Quiz n.: 4.1
Peer assessment	No
Unit 2: Energy efficiency and fuels substitutio based on waste resources	.
Content	Utilization of waste biomass. Waste derived fuels as alternatives or substitutes of fossil fuels. The energy efficiency in different industrial process from the use of recycled or recovered materials. Comparison between raw material and recycled in terms of environmental impact and energy utilization.
Tags:	Raw materials. Waste Derived fuels. Substituting fuels. Energy savings from recycling or reuse.
Assignment n.: 4	Quiz n.: 4.1

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises

LESSON 8: The life cycle analysis in the production and operation of the equipment	Date: June 4, 2020
Learning Objectives	At the end of the lesson, students will be able to: · Understand the importance of Life Cycle Thinking in the production and operation of equipment; · Identify the life stages that may have a higher impact on the environment; · Associate energy consumption and total cost with different stages.
UNIT 1: LCA definitions	
Content	Life Cycle Analysis definitions. Stages in the life of a product. Life Cycle Costing. Energy and materials costs in different stages.
Tags:	LCA. LCCA. Material costs. Energy Costs.
Assignment n.: 5.1	Quiz n.: 5.1

Peer assessment	No
Unit 2: LCA and life cycle thinking – Life Cycle Cost Analysis	
Content	Life Cycle Analysis in evaluating energy using products and the role of energy efficiency. Life Cycle Costing Analysis and Total Cost of Ownership approach in selecting equipment and products or services. Technical and economic assessment: criteria and tools. Case studies.
Tags:	Total Cost of Ownership. LCCA. LCA. Energy Efficiency in use phase.
Assignment n.: 5.1	Quiz n.: 5.1

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises

2.4.2.16 Energy Efficient and Ecological Design of Products and Equipment

Course Title	Energy Efficient and Ecological Design of Products and Equipment
To be publish 02/04/2020 Closing date 18/06/2020	Dr. Psomopoulos Constantinos – Professor UWA
Overview	Introduction to Energy Efficiency and EcoDesign. The EU Energy Efficiency and EcoDesign Directives. The Economics of Energy Efficient Design and EcoDesign of products Consumer Orientation - Innovation through Eco-Design and Energy efficient Design The development of a strategy for Eco and Energy efficient design - The connection of the energy and environmental aspects of the design process

	Analysis of the Concepts and Methodologies. Basic Tools for the Energy efficient and Eco Design of Products. The Life Cycle Analysis for designers and Total Cost of Ownership for consumers The role of RES in ecological design of systems and products Equipment and Products case studies and examples.
Learning Objectives	The MOOC aims to give an overview and the knowledge for the implementation of the eco-design approach and principles in every product or system design in the context of the energy transition. In particular, using a case-based approach, and tools' analysis and use, the course will start with the basic and core legislation then moving to the economics and working principle and methodologies used for implementing eco-design and energy efficient design. After examples of energy and environmental performance indicators calculations and presentation of different approaches and case studies, the implementation in every potential product or system is presented and discussed, under the context of smart, affordable and sustainable energy context.
Outcomes	Once students have completed the course, they will be able to: Analyze the EU Energy Efficiency, EcoLabel, EcoDesign, RoHS and WEEE Directives. Identify the connection of the energy and environmental aspects of the design process of a product and a system, during the total life cycle of a product. Identify the Economics of Energy Efficient Design and EcoDesign of products and systems. Identify the Consumer Orientation - Innovation through Eco-Design and Energy efficient Design, based on the total life cycle analysis approach. Combine methods for developing and adopting strategies for Eco and Energy efficient design of products and systems through analysis of all phases in their life and reverse engineering approaches. Analyze different components and methods for reducing the impact of a product or equipment in the environment during the different phases of its life cycle. Combine the Concepts and Methodologies and Basic Tools for the Energy efficient and Eco Design of Products. Ability to perform Life Cycle Analysis and Life Cycle Costing Analysis during the design of a product and the calculation of the Total Cost of Ownership

	Intergrade RES during the energy efficient and ecological/sustainable design process or during improvement schemes for systems and products. Ability to perform the studies and work and to assess their results considering this parameter. Ability to use the principles and methodologies of energy efficient and ecological / sustainable design (Eco-Design) in his professional activity.
LESSON 1: Introduction to Energy Efficiency and EcoDesign. The EU Energy Efficiency and EcoDesign Directives.	Date: April 2, 2020
Learning Objectives	Students will learn the basic terminology and definitions used in energy efficiency and ecodesign. Also, will learn and understand the EU directives on Eco-Design and Energy Efficiency as well as the connected Directives of Eco-Label and WEEE directives.
UNIT 1: Basic Terminology	
Content	Basic terminology and definitions in the fields of energy, environment, and ecodesign.
Tags:	Energy intensity. Energy consumption. Energy efficiency. EcoDesign. Environmental Impact. Raw materials
Assignment n.: 1	Quiz n.: 1.1
Peer assessment	No
Unit 2: Introduction to Energy Efficiency and EcoDesign.	
Content	Energy savings. Actions, measures. Energy Efficiency and energy efficient products. Energy efficiency concepts and measures. EcoDesign. Concepts, environmental impact and connection to energy efficiency.
Tags:	Energy Efficiency. Energy Savings. EcoDesign.
Assignment n.: 1	Quiz n.: 1
Peer assessment	No
UNIT 3: The EU Energy Efficiency and EcoDesign Directives.	

Content	Energy Efficiency Directive. Calculation of Energy efficiency indicators. Fields of implementation. Expected results and benefits. Ecodesign Directive. Restrictions and Calculations of indicators. Fields of implementation. EcoDesign Regulations Expected results and benefits. Connected directives RoHS Directive, EcoLabel, EPBD Directive, EMAS.
Tags:	Energy Efficiency Directive. EcoDesign Directive. EcoDesign Regulation. Eco-Label.
Assignment n.: 1	Quiz n.: 1.1
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 2: Environmental indicators in energy efficient design and ecodesign	Date: April 30, 2020
Learning Objectives	Students will learn the basics associated with the environmental indictors associated with the ecodesign. Hazardous substances and toxicity in the selection of raw materials or in common electric and electronic products and equipment. Emissions on air, water and land as key indicators during the ecodesign process. Environmental impact assessment under the ecodesign and energy efficiency design. RoHS directive.
UNIT 1: Basic Terminology on environment and toxicology	
Content	Basic terminology and definitions in the fields of environment and toxicology and environmental indicators.
Tags:	Environmental indicators. Ecotoxicology.

Assignment n.: 1	Quiz n.: 1.1
Peer assessment	No
Unit 2: Environmental indicators in Energy Efficient Design and EcoDesign.	
Content	Environmental indicators used in energy efficient design and ecodesign. Toxicological indicators. Evaluating the toxic equivalent of substances and materials used in the products design.
Tags:	Environmental indicators. Toxicological indicators. Toxic equivalent.
Assignment n.: 1	Quiz n.: 1
Peer assessment	No
UNIT 3: Evaluating the environmental impact.	
Content	Evaluation of the environmental impact under the ecodesign context. GHG emissions, emissions in water and land, toxicity calculation. Methods for reduction of the environmental impact.
Tags:	Environmental impact. Emissions. Toxic equivalent calculation.
Assignment n.: 1	Quiz n.: 1.1
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 3: The Economics of Energy Efficient Design and EcoDesign of products	Date: May 7, 2020
Learning Objectives	The students will elaborate and understand the economics that are associated with the energy efficient design and ecodesing of products.

UNIT 1: The Economics of Energy Efficient Design and EcoDesign of products	
Content	Analysis of the economic issues associated and affecting the ecodesign and the energy efficient design. The impacts on the production cost and ownership costs. Economic issues for consumers and markets.
Tags:	Ecodesign economics. Reduced operating cost. Total cost of a product.
Assignment n.: 1	Quiz n.: 1.2
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 4: Consumer Orientation - Innovation through Eco-Design and Energy efficient Design	Date: May 14, 2020
Learning Objectives	At the end of the lesson, students will be able to identify the Consumer Orientation and the innovation potential and possibilities through Eco-Design and Energy efficient Design, based on the total life cycle analysis approach.
UNIT 1: Consumer Orientation	
Content	The key role of consumers' approach and view point in energy efficient design and ecodesign. Parameters affecting the selection of consumers and the role of labelling in consumer orientation.
Tags:	Consumers' orientations. Green products. Labelling as purchasing criteria.
Assignment n.: 1	Quiz n.: 1.2
Peer assessment	No

UNIT 2: Innovation through Eco-Design and Energy efficient Design	
Content	Relation of innovation through ecodesign. The role life cycle thinking in products design as power driving to new innovative solutions. The different aspects of innovation under the ecodesign thinking. Case studies. Market situation and perspectives.
Tags:	Innovation in ecodesign. Innovation in design concepts.
Assignment n.: 1	Quiz n.: 1.2
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises
Blog postDissemination/Communication
Virtual classroom
Conversation tool

LESSON 5: The connection of the energy and environmental aspects during the design process. Analysis of the Concepts and Methodologies.	Date: May 21, 2020
Learning Objectives	At the end of the lesson, students will be able to: • Understand and use of the directives; • Evaluate their impact on specific products or systems; • Calculate specific indicators related to them.
UNIT 1: Basic concepts for energy efficient design and ecodesign of a product	
Content	• The design process and what determines. • The life cycle thinking during design • The concept of energy efficient design of a product. • Basic concept of ecodesign of a product. • From energy efficient design to ecodesign.
Tags:	Design process. Ecodesign concept. Energy efficient design concept. Life cycle thinking design.
Assignment n.: 2	Quiz n.: 2.1

Peer assessment	No
Unit 2: The connection of the energy and environmental aspects during the design process	
Content	• Design process and what determines. • Analysis of raw materials selection on environmental impact. • The role of packaging and logistics. • Impact from the manufacturing or construction process • Materials and energy consumption in all phase of the life cycle. • The life cycle thinking during design
Tags:	Design process. Raw materials. Manufacturing process. Materials during life cycle. Life cycle thinking design.
Assignment n.: 2	Quiz n.: 2.1
Peer assessment	No
PEDAGOGICAL TOOLS	
Study materials, Presentations, reading and exercises	
Blog post Dissemination/Communication	
Virtual classroom	
Conversation tool	

LESSON 6: The Life Cycle Analysis and Total Cost of Ownership	Date: May 28, 2020
Learning Objectives	At the end of the lesson, students will be able to perform Life Cycle Analysis and Life Cycle Costing Analysis during the design of a product and the calculation of the Total Cost of Ownership.
UNIT 1: Life Cycle Analysis	
Content	Definitions and vocabulary in Life Cycle Analysis. Boundaries and limits. Scope. Life Cycle stages evaluation. Cut-off Criteria. Impact Evaluation. Qualitative and semi-quantitative methods. Life Cycle Analysis implementation. Method 5x5 Case studies
Tags:	Life Cycle Analysis. Boundaries. Quantitative and Qualitative methods. Cut-of Criteria.

Assignment n.: 3	Quiz n.: 3.1
Peer assessment	No
Unit 2: Life Cycle Costing Analysis and Total Cost of Ownership	
Content	Definitions and vocabulary in Life Cycle Costing Analysis and Total Cost of Ownership. Boundaries and limits. Scope. Life Cycle Costing stages evaluation. Criteria. Total Cost of Ownership for companies and for consumers. Qualitative and quantitative methods. Life Cycle Costing Analysis implementation. Case studies
Tags:	Life cycle costing analysis. Total Cost of Ownership
Assignment n.: 3	Quiz n.: 3.1
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Presentations, reading and exercises
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 7: Basic Tools for the Energy efficient and Eco Design. Part 1	Date: June 4, 2020
Learning Objectives	At the end of the lesson, students will be able to: • Combine methods for developing and adopting strategies for Eco and Energy efficient design of products and systems through analysis of all phases in their life and reverse engineering approaches. • Analyze different components and methods for reducing the impact of a product or equipment in the environment during the different phases of its life cycle. • Combine the Concepts and Methodologies and Basic Tools for the Energy efficient and Eco Design of Products.

UNIT 1: MEErP Methodology for Ecodesign of Energy-related Products – Materials Efficiency	
Content	The EU method for Ecodesign MEErP Methodology for Ecodesign of Energy-related Products used for every preparatory study to evaluate the impact and to implement ecodesign regulations in products. The materials efficiency analysis under this method.
Tags:	Materials Efficiency. MEErP
Assignment n.: 4	Quiz n.: 4.1
Peer assessment	No
Unit 2: Enhancing MEErP for Ecodesign	
Content	The EU method for Ecodesign MEErP. Presentation and analysis of the tool. Case studies.
Tags:	MEErP
Assignment n.: 4	Quiz n.: 4.1
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 8: Basic Tools for the Energy efficient and Eco Design of Products. Part2	Date: June 11, 2020
Learning Objectives	At the end of the lesson, students will be able to: • Combine methods for developing and adopting strategies for Eco and Energy efficient design of products and systems through analysis of all phases in their life and reverse engineering approaches. • Analyze different components and methods for reducing the impact of a product or equipment in the environment during the different phases of its life cycle.

	• Combine the Concepts and Methodologies and Basic Tools for the Energy efficient and Eco Design of Products.
UNIT 1: EcoDesign Pilot	
Content	Presentation and analysis of the Product Investigation, Learning and Optimization Tool for Sustainable Product Development. Case studies.
Tags:	EcoDesignPilot
Assignment n.: 4	Quiz n.: 4.3
Peer assessment	No
Unit 2: Comparison between MEErP and EcoDesign Pilot	
Content	Evaluating and comparing the two methodological approaches on eco-design using also the freeware calculation tools that they have.
Tags:	Raw materials. Waste Electrical and electronic equipment. Recycling.
Assignment n.: 4	Quiz n.: 4.4
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 9: The development of a strategy for Eco and Energy efficient design	Date: June 18, 2020
Learning Objectives	At the end of the lesson, students will be able to: • Develop a strategy for improving the energy performance of a product or a system during the design;

	• Develop of a strategy for improving the environmental performance of a product or a system during design; • Evaluate the role of environmental aspects and energy consumption during design, for all life cycle of a product;
UNIT 1: Identification of improvement potential	
Content	• Identification of possible and potential improvements on different stages in the products life. • Evaluation of the possibility and obstacles for improvements.
Tags:	Design process. Improvement potential.
Assignment n.: 5	Quiz n.: 5.1
Peer assessment	No
Unit 2: The development of a strategy for Eco and Energy efficient design	
Content	• Strategies targeting on the usage phase of a product. • Strategies for specific phases of the product's or the system's life • Strategies for the manufacturing /construction process. • Packaging and logistics strategies. • Strategies for end-of-life treatment alternatives. • Design for recyclability and reparability. • The design choices and their impact through specific cases studies. • Evaluation of the impact of each strategy.
Tags:	Ecodesign strategies. Design for recyclability. Design for reparability. Energy efficient design.
Assignment n.: 5	Quiz n.: 5.1
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 10: The role of RES in ecological design of systems and products	Date: June 25, 2020
Learning Objectives	At the end of the lesson, students will be able to intergrade RES during the energy efficient and ecological/sustainable design process or during improvement schemes for systems and products.
UNIT 1: Integration of small scale RES in products and equipment.	
Content	Development of strategies for RES operating small electrical or electronic products. Integration of small scale RES in products. Efficiency improvement and improvement of environmental impact. Case studies.
Tags:	Small Scale RES. RES integration in products.
Assignment n.: 5.1	Quiz n.: 5.1
Peer assessment	No
Unit 2: RES Integration in the product's Life Cycle	
Content	Integration of RES in the product's life cycle. Strategies for implementation. The role of RES in the in LCA, LCCA and TCO. Technical and economic assessment: criteria and tools. Case studies.
Tags:	RES integration in product's life cycle.
Assignment n.: 5	Quiz n.: 5.2
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 11: Case Studies for products	Date: July 2, 2020
Learning Objectives	At the end of the lesson, students will be able to: • Ability to perform the studies and work and to assess their results considering this parameter. • Ability to use the principles and methodologies of energy efficient and ecological / sustainable design (Eco-Design) in his professional activity.
UNIT 1: EcoDesign/ Energy Efficient Design Implementation Case studies	
Content	Products case studies in selected sectors: Electrical and Electronics products. Case studies for product improvement and for new designs.
Tags:	Ecodesign Case studies
Assignment n.: 6.	Quiz n.: 6.
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Presentations, reading – videos and exercises
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 12: Case studies for Products and Systems	Date: July 09, 2020
Learning Objectives	At the end of the lesson, students will be able to: • Ability to perform the studies and work and to assess their results considering this parameter.

	• Ability to use the principles and methodologies of energy efficient and ecological / sustainable design (Eco-Design) in his professional activity.
UNIT 1: Case Studies for Products	
Content	Products case studies in selected sectors : Power Sector Products. Case studies for product improvement and for new designs.
Tags:	Ecodesign Case studies
Assignment n.: 6.	Quiz n.: 6.1
Peer assessment	No
UNIT 2: Case Studies for Systems.	
Content	From product to system approach in energy efficient design and ecodesign. Case studies in selected sectors : Production lines as system's approach in energy efficient design and ecodesign. Case studies for improvement and for new designs.
Tags:	Ecodesign Case studies for systems
Assignment n.: 6.	Quiz n.: 6.1
Peer assessment	No

PEDAGOGICAL TOOLS
Study materials, Case studies and exercises
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

2.4.3 Delivery activities

This session covers the needs of promotion activities. The tables below collect the information of Form B MOOC Description (see Annex I) aiming at streamlining and managing the process of launching MOOC and starting the activity of enrolling.

2.4.3.1 Delivery Activities: Optimization Strategies and Energy Management Systems

Item	Description in English
Title of MOOC	**Optimization Strategies and Energy Management Systems**
MOOC teaser	This course focuses on the formulation of different optimization problems in planning, operation and control of energy systems, and solving them using existing softwares and solvers. The simulation handbook and exercises provided in the course are based on real-use cases and will be extremely useful for researchers and practitioners working in energy auditing, energy planning, and energy conservation.

Item	Description in English
Name of person completing this form	Mashood Nasir
Available languages	EN
Availability of intro video (Date)	June 1, 2020
Enrolment start date	Aug 1, 2020
Start date MOOC	Oct 15, 2020
Duration	4 weeks
Promotional contact	Mashood Nasir, mnas@et.aau.dk, +45 91498791
Delivery contact	Josep M. Guerrero, joz@et.aau.dk, +4520378262 Dr. Moisès Graells, email, phone

	Dr. Eleonora Riva Sanseverino, email, phone

2.4.3.2 Delivery Activities: Power Quality Challenges and Solutions for Microgrids

Item	Description in English
Title of MOOC	**Power Quality Challenges and Solutions for Microgrids**
MOOC teaser text	The proliferation of nonlinear loads in electrical systems results in power quality problems. Therefore, measurement, compensation, and damping of power quality problems will be addressed in this course. The simulation handbook and exercises provided in the course are based on real-use cases and will be useful to develop insights into mitigating the power quality issues, both for industry practitioners and researchers.

Item	Description in English
Name of person completing this form	Mashood Nasir
Available languages	EN
Availability of intro video (Date)	June 1, 2020
Enrolment start date	Aug 1, 2020
Start date MOOC	Oct 15, 2020
Duration	4 weeks

Promotional contact	Mashood Nasir, mnas@et.aau.dk, +45 91498791
Delivery contact	Juan C. Vasquez, juq@et.aau.dk, +45 9940 9724 Dr. Alexander Micallef, email, phone Dr. Mehdi Savaghebi, email, phone

2.4.3.3 Delivery Activities: Maritime Microgrids – A Sustainable Solution for Green Sea Transportation

Item	Description in English
Title of MOOC	**Maritime Microgrids – A Sustainable Solution for Green Sea Transportation**
MOOC teaser text	This course provides an overview of the present and future architectures of maritime microgrids, associated control technologies, optimization methods, power quality issues and state of the art solutions. The simulation handbook and exercises provided in the course are based on real-use cases and will be extremely useful to develop insights into the control, optimization and energy management of integrated power systems for maritime industry practitioners and researchers.

Item	Description in English
Name of person completing this form	Mashood Nasir
Available languages	EN
Availability of intro video (Date)	June 1, 2020

Enrolment start date	Aug 1, 2020
Start date MOOC	Oct 15, 2020
Duration	4 weeks
Promotional contact	Mashood Nasir, mnas@et.aau.dk, +45 91498791
Delivery contact	Josep M. Guerrero, joz@et.aau.dk, +4520378262 Juan C. Vasquez, juq@et.aau.dk, +45 9940 9724 Prof. Tomasz Tarasiuk

2.4.3.4 Delivery Activities: An Introduction to AC Microgrids for Energy Control and Management

Item	Description in English
Title of MOOC	**An Introduction to AC Microgrids for Energy Control and Management**
MOOC teaser text	This course focuses on the modeling, operation and control of AC microgrids for resilient and efficient integration of renewable/non-renewable energy resources and storage technologies. The simulation handbook and exercises are based on real-use cases and will be useful to develop insights into AC microgrid control and management for industry practitioners and researchers

Item	Description in English
Name of person completing this form	Mashood Nasir
Available languages	EN

Availability of intro video (Date)	June 1, 2020
Enrolment start date	Aug 1, 2020
Start date MOOC	Oct 15, 2020
Duration	4 weeks
Promotional contact	Mashood Nasir, mnas@et.aau.dk, +45 91498791
Delivery contact	Josep M. Guerrero, joz@et.aau.dk, +4520378262 Juan C. Vaquez, juq@et.aau.dk, +4520378621

2.4.3.5 Delivery Activities: An Introduction to DC Microgrids for Energy Control and Management

Item	Description in English
Title of MOOC	**An Introduction to DC Microgrids for Energy Control and Management**
MOOC teaser text	This course focuses on the modeling, operation and control design of DC microgrids for resilient and efficient integration of renewable/non-renewable energy resources and storage technologies. The simulation handbook and exercises provided in the course are based on real-use cases and will be extremely useful to develop insights into DC microgrid control and management for industry practitioners and researchers.

Item	Description in English
Name of person	Mashood Nasir

completing this form	
Available languages	EN
Availability of intro video (Date)	June 1, 2020
Enrolment start date	Aug 1, 2020
Start date MOOC	Oct 15, 2020
Duration	4 weeks
Promotional contact	Mashood Nasir, mnas@et.aau.dk, +45 91498791
Delivery contact	Josep M. Guerrero, joz@et.aau.dk, +4520378262 Juan C. Vasquez, juq@et.aau.dk, +45 9940 9724

2.4.3.6 Delivery Activities: Innovation and Diversity in Engineering

Item	Description in English	Description (own language)
Title of MOOC	**Innovation and Diversity in Engineering**	Innovation und Diversität im Ingenieurwesen

MOOC teaser text	The course deals with the context between the development of sustainable innovations and diversity and with the question how culture shapes and impacts engineering. A MOOC will be developed to understand the diversity among people with whom you work in technology-based enterprises, and for whom you design products and services. We will not only have text but also group works and give room for discussions and the exchange of different views and ideas.	Der Kurs beschäftigt sich mit dem Kontext zwischen der Entwicklung nachhaltiger Innovationen und Vielfalt und der Frage, nach den Wechselwirkungen von Technikentwickung Gesellschaftund Kultur. Ziel ist die Sensibilisierung der Teilnehmenden für Diversität, um möglichst erfolgreich mit unterschiedlichsten Menschen, mit denen Sie in technologiebasierten Unternehmen arbeiten werden und für die Sie Produkte und Dienstleistungen entwickeln werden, Soziale Nachhaltigkeit wird dabei als wichtiger Treiber für erfolgreiche Innovationen adressiert.

Item	Description in English
Name of person completing this form	Julia Berg, julia.berg@gdi.rwth-aachen.de, +492418090631
Available languages	EN
Availability of intro video (Date)	August 2020
Enrolment start date	September 2020
Start date MOOC	October 2020
Duration	8 weeks
Promotional contact	Julia Berg, julia.berg@gdi.rwth-aachen.de, +492418090631

Delivery contact	Julia Berg, julia.berg@gdi.rwth-aachen.de, +492418090631

2.4.3.7 Delivery Activities: Challenges and solutions in Future Power Networks

Item	Description in English
Title of MOOC	**Challenges and solutions in Future Power Networks**
MOOC teaser text	If you are looking for a program that keeps you up with new innovative solutions for the power network of the future, then this course is for you. Learn about the challenges in and solutions for frequency control, voltage control, simulations, and monitoring.

2.4.3.8 Delivery Activities: Renewable Energy Technologies

Item	Description in English	to complete (your own language)
Title of MOOC	**Renewable Energy Technologies**	Tecnologia delle fonti rinnovabili di energia
MOOC teaser text	Renewable energy sources play a key role in the transition toward a zero-carbon society: by 2050, they are expected to supply more than 2/3 of the global energy demand, strongly contributing to reduce greenhouse gas emissions and limiting the effects of global warming. The MOOC offers an up-dated and comprehensive overview of renewable energy technologies, from technical and economic perspectives.	Le fonti energetiche rinnovabili hanno un ruolo chiave nella transizione energetica in atto: entro il 2050, ci si aspetta che arrivino a coprire oltre 2/3 della richiesta energetica mondiale, contribuendo in modo decisivo alla riduzione delle emissioni di gas serra. Il MOOC offre una panoramica aggiornata e completa delle tecnologie per l'uso delle fonti rinnovabili, da un punto di vista tecnico-economico.

Item	Description in English
Name of person completing this form	Massimo Dentice d'Accadia
Available languages	EN
Availability of intro video (Date)	*March 23, 2020*
Enrolment start date	April 6, 2020
Start date MOOC	April 27, 2020
Duration	8 weeks
Promotional contact	
Delivery contact	Massimo Dentice d'Accadia, dentice@unina.it, (+39)3403046947

2.4.3.9 Delivery Activities: Electric heat Pumps in the Energy Transition Framework

Item	Description in English	Description (own language)
Title of MOOC	**Electric heat pumps in the energy transition framework**	Pompe di calore elettriche nel contesto della transizione energetica
MOOC teaser text	An overview on electric heat pumps with a case-based approach: data from the user, working principle and technologies, regulations, energy and environmental impact indicators, sizing in a basic case and interaction with a real building, thermal energy storage technologies and perspective of application in complex systems	Una panoramica sulle pompe di calore elettriche con un approccio basato su un caso studio: dati di utenze, principio di funzionamento e tecnologie, regolamenti, indicatori di impatto ambientale e prestazione energetica, dimensionamento in un caso base e interazione con un edificio reale, tecnologie per lo stoccaggio di energia termica e prospettiva di applicazione in sistemi complessi

Item	Description in English
Name of person completing this form	Prof. Alfonso William Mauro, wmauro@unina.it
Available languages	EN
Availability of intro video (Date)	*YES*
Enrolment start date	Two months before the start date
Start date MOOC	April 2020
Duration	9 weeks
Promotional contact	
Delivery contact	Prof. Alfonso William Mauro, wmauro@unina.it

2.4.3.10 Delivery Activities: Corporate communication and corporate social responsibility

Item	Description in English	Description (own language)
Title of MOOC	**Corporate Communication and Corporate Social Responsibility**	Comunicazione d'impresa e responsabilità sociale.
MOOC teaser text	Today corporate social responsibility means environmental responsibility. Communicate the company's attention on sustainability is a relevant factor of success, but also a difficult challenge. Consumers have become more informed, attentive, skeptical and proactive, while information on the web is often uncontrolled. The course will provide	Oggi responsabilità sociale delle imprese significa responsabilità ambientale. Comunicate l'attenzione aziendale alla sostenibilità è infatti un fattore di successo, ma anche una sfida. I consumatori sono divenuti più informati, attenti, scettici e proattivi, mentre le informazioni viaggiano sul web spesso incontrollate. Il corso fornirà le

	essential information to face this complex topic by focusing on energy companies.	informazioni utili a districarsi in questo complesso campo focalizzandosi sulle imprese energetiche.

Item	Description in English
Name of person completing this form	Ivano Scotti ivano.scotti@sp.unipi.it +39 333 6887899
Available languages	EN
Enrolment start date	April 2020
Start date MOOC	April 2020
Duration	6 weeks

2.4.3.11 Delivery Activities: Green professionalization and ethics

Item	Description in English	Description (own language)
Title of MOOC	**Green professionalization and ethics**	La professionalizzazione 'verde' e la sua etica

MOOC teaser text	Professions are involved in and, somehow, transformed by the energy transition. New skills are required, both from the technical and social fields. These “green collars” have to deal with the institutionalization of the ecological values and the local knowledge of the territories. The course will explore this issue with reference to the role of the professionals in promoting a fair and sustainable energy transition.	Il mondo delle professioni è a pieno titolo coinvolto nelle trasformazioni socio-economiche della transizione energetica. La domanda di nuove competenze, tecniche e sociali, rappresenta una sfida per questi “green collars” che devono confrontarsi con l’istituzionalizzazione dei valori ecologici e con i saperi dei locali dei territori. Il corso esplorerà queste interconnessioni, approfondendo il ruolo dei professionisti nella promozione di una transizione energetica equa e sostenibile.

Item	Description in English
Name of person completing this form	Dario Minervini, Email: dario.minervini@unina.it +39 348 4723106
Available languages	EN
Enrolment start date	April 2020
Start date MOOC	April 2020

2.4.3.12 Delivery Activities: An holistic approach for energy transition: territory, networks and sustainability

Item	Description in English

Title of MOOC	**A holistic approach for Energy Transition: territory, networks and sustainability.**
MOOC teaser text	This course focuses on the socio-territorial and environmental perspective in order to understand ET as social construction process. We will address the concepts of sustainability and of participatory planning and their implications in terms of cooperation/conflict. Social Network Analysis will be used to identify: network as a tool of participatory planning; the central actors in the social construction of the ET.

Item	Description in English
Name of person completing this form	Anna Maria Zaccaria
Available languages	English
Enrolment start date	April 2020
Start date MOOC	April 2020
Duration	6 weeks
Promotional contact	Anna Maria Zaccaria, zaccaria@unina.it, +39 3279907026
Delivery contact	Rosanna De Rosa, shine@netfly.it, +39 3284689155

2.4.3.13 Delivery Activities: Hydrogen as energy vector

Item	Description in English

Title of MOOC	**Hydrogen as Energy Vector**
MOOC teaser text	The course provides the fundaments of the hydrogen technology, using it as a way to store energy. Hydrogen production methods are presented, but more special attention is paid to electrolysis as a means for producing hydrogen from renewable energies. Hydrogen storage methods are described, and it is explained process of electrical energy generation from hydrogen by using fuel cell technology.

Item	Description in English
Name of person completing this form	Carlos Sánchez Díaz, csanched@eln.upv.es +34 636 090 147
Available languages	EN/ES
Availability of intro video (Date)	*March 2020*
Enrolment start date	March 2020
Start date MOOC	21 / April / 2020
Duration	6 weeks
Delivery contact	Carlos Sánchez Díaz, csanched@eln.upv.es +34 636 090 147

2.4.3.14 Delivery Activities: Energy and environment

Item	Description in English	Description (own language)
Title of MOOC	**Energy and environment**	Ενέργεια και Περιβάλλον
MOOC teaser text	What is the relation of the energy production and consumption with the environment, and the climate change? Why we should be considered the the environment when we buy and operate any goods consuming energy? How we can reduce the environmental impact of our energy consumption to the environment?	Ποια είναι η σχέση της παραγωγής και κατανάλωσης ενέργειας με το περιβάλλον και την κλιματική αλλαγή; Γιατί πρέπει να σκεφτόμαστε το περιβάλλον όταν αγοράζουμε και χρησιμοποιούμε συσκευές που καταναλώνουν ενέργεια; Πως μπορούμε να μειώσουμε τις περιβαλλοντικές επιπτώσεις από την κατανάλωση ενέργειας;

Item	Description in English
Name of person completing this form	Dr. Constantinos S. Psomopoulos – Professor cpsomop@uniwa.gr +306974509948
Available languages	EN/EL
Availability of intro video (Date)	EN
Enrolment start date	31/3/2020
Start date MOOC	2/4/2020
Duration	10 weeks
Promotional contact	Dr. Constantinos S. Psomopoulos – Professor cpsomop@uniwa.gr +306974509948

Delivery contact	Dr. Constantinos S. Psomopoulos – Professor cpsomop@uniwa.gr +306974509948

2.4.3.15 Delivery Activities: Train the trainer

Item	Description in English
Title of MOOC	**TRAIN THE TRAINER**
MOOC teaser	Discover Training by Learning, Discover Training by Training! Practice, empathy, motivation, communication techniques will be your assets!

Item	Description in English
Name of person completing this form	Georgia Papadimitriou gpapadimitr@ote.gr-00306978892323
Available languages	EN
Availability of intro video (Date)	*No INTRO VIDEO*
Enrolment start date	15/04
Start date MOOC	15/05
Duration	6 weeks

2.4.3.16 Delivery Activities: New material for solar cells applications

Item	Description in English	Description (own language)
Title of MOOC	**New Materials for solar cells applications**	Νέα υλικά για ηλιακά κύτταρα (φωτοβολταικά)
MOOC teaser text	· What is unique in this lesson? Solar cell types comparison!! · A new presentation of commercial thin-film solar cells technology · Slides – attractive videos and tests for the students	· Σημαντική παρουσίαση της σύγκρισης νέων τεχνολογιών σε ηλιακά κύτταρα!! · Νέα πρωτότυπη παρουσίαση τεχνολογιών σε λεπτά φιλμ(υμένια) · Ελκυστικά Βίντεο και παρουσιάσεις καθώς και ασκήσεις για φοιτητές

Item	Description in English
Name of person completing this form	Dr. Theodore Ganetsos – Professor ganetsos@uniwa.gr ++306945273390
Available languages	EN
Availability of intro video (Date)	*31/1/2020*
Enrolment start date	2/3/2020
Start date MOOC	2/3/2020
Duration	13 weeks
Promotional contact	Dr. Theodore Ganetsos
Delivery contact	Dr. Theodore Ganetsos ganetsos@uniwa.gr ++306945273390

2.4.3.17 Delivery Activities: Energy and environment

Item	Description in English	Description (own language)
Title of MOOC	**Energy and environment**	Ενέργεια και Περιβάλλον
MOOC teaser text	What is the relation of the energy production and consumption with the environment, and the climate change? Why we should be considered the environment when we buy and operate any goods consuming energy? How we can reduce the environmental impact of our energy consumption to the environment?	Ποια είναι η σχέση της παραγωγής και κατανάλωσης ενέργειας με το περιβάλλον και την κλιματική αλλαγή; Γιατί πρέπει να σκεφτόμαστε το περιβάλλον όταν αγοράζουμε και χρησιμοποιούμε συσκευές που καταναλώνουν ενέργεια; Πως μπορούμε να μειώσουμε τις περιβαλλοντικές επιπτώσεις από την κατανάλωση ενέργειας;

Item	Description in English
Name of person completing this form	Dr. Constantinos S. Psomopoulos – Professor cpsomop@uniwa.gr +306974509948
Available languages	EN/EL
Availability of intro video (Date)	EN
Enrolment start date	31/3/2020
Start date MOOC	2/4/2020

Duration	10 weeks
Promotional contact	Dr. Constantinos S. Psomopoulos – Professor cpsomop@uniwa.gr +306974509948
Delivery contact	Dr. Constantinos S. Psomopoulos – Professor cpsomop@uniwa.gr +306974509948

2.4.3.18 Delivery Activities: Energy Efficient and Ecological Design of Products and Equipment

Item	Description in English	Description (own language)
Title of MOOC	**Energy Efficient and Ecological Design of Products and Equipment**	Ενεργειακός και Οικολογικός Σχεδιασμός Η/Μ Εξοπλισμού και προϊόντων
MOOC teaser text	What is the ecological design of the products and equipment? How we can design a product in order to be more energy efficient and more environmental friendly? What are the tools we need to improve the efficiency of a product and reduce its impact to the environment? Why is important to embrace ecological design and energy efficient design to every product?	Τι σημαίνει οικολογικός και ενεργειακά αποδοτικός σχεδιασμός ενός προϊόντος; Πως μπορούμε να σχεδιάσουμε ένα προϊόν ώστε να είναι φιλικότερο προς το περιβάλλον και ενεργειακά πιο αποδοτικό; Ποια είναι τα πλέον αποδοτικά εργαλεία για τη βελτίωση της αποδοτικότητας και να μειώσουμε τις επιπτώσεις του στο περιβάλλον; Γιατί είναι σημαντικό να εφαρμόζονται παντού οι αρχές και οι μεθοδολογίες του οικολογικού και ενεργειακά αποδοτικού σχεδιασμού;

Item	Description in English
Name of person completing this form	Dr. Constantinos S. Psomopoulos – Professor cpsomop@uniwa.gr +306974509948

Available languages	EN/EL
Availability of intro video (Date)	EN
Enrolment start date	31/3/2020
Start date MOOC	2/4/2020
Duration	13 weeks
Promotional contact	Dr. Constantinos S. Psomopoulos – Professor cpsomop@uniwa.gr +306974509948
Delivery contact	Dr. Constantinos S. Psomopoulos – Professor cpsomop@uniwa.gr +306974509948

2.5 Timelines for programme delivery

The timelines for MOOC programmes delivery for both the pilot phase are shown in Table 54. While Table 55 shows the overall MOOC delivery Gantt chart including the first iteration to inculcate the feedback from the pilot phase.

MOOC OFFER: PILOT PHASE							
MOOC Title	**EQF**	**Short description**	**University Dept**	**Launch Date**	**Delivery Date**	**Target Group/n. students expected**	**IPR**
 An Introduction to AC Microgrids for Energy Control and Management	7-8	This course focuses on the modeling, operation, and design of AC microgrids for resilient and efficient integration of renewable/non-renewable energy resources and storage technologies.	Aalborg University	Aug 2020	Oct 2020	Employees of industries and energy companies, trainers and students from electrical engineering and energy technology institutions along with all other individuals interested in energy auditing, energy efficiency, and energy planning.	CC BY-SA-ND
	7-8	This course focuses on the modeling, operation and	Aalborg University	Aug 2020	Oct 2020	Employees of industries and energy companies, trainers and	CC BY-SA-ND

An Introduction to DC Microgrids for Energy Control and Management		control design of DC microgrids for resilient and efficient integration of renewable/non-renewable energy resources and storage technologies.				students from electrical engineering and energy technology institutions along with all other individuals interested in energy auditing, energy efficiency, and energy planning.	
 Optimization Strategies and Energy Management Systems		This course focuses on the formulation of different optimization problems in planning, operation and control of energy systems, and solving them using existing software and solvers.	Aalborg University	Aug 2020	Oct 2020	Employees of industries and energy companies, trainers and students from electrical engineering and energy technology institutions along with all other individuals interested in energy auditing, energy efficiency, and energy planning.	CC BY-SA-ND
 Maritime Microgrids -A Sustainable Solution for Green Sea Transportation	7-8	This course provides an overview of the present and future architectures of maritime microgrids, associated control technologies, optimization methods, power quality issues and state of the art solutions.	Aalborg University	Aug 2020	Oct 2020	Employees of industries and energy companies, trainers and students from electrical engineering and energy technology institutions along with all other individuals interested in energy auditing, energy efficiency, and energy planning.	CC BY-SA-ND

 Power Quality Challenges and Solutions for Microgrids	7 - 8	The proliferation of nonlinear loads in electrical systems results in power quality problems. Therefore, measurement, compensation, and damping of power quality problems will be addressed in this course.	Aalborg University	Oct 2020	Oct 2020	Employees of industries and energy companies, trainers and students from electrical engineering and energy technology institutions along with all other individuals interested in energy auditing, energy efficiency, and energy planning.	CC BY-SA-ND
 Challenges and solutions in Future Power Networks	7 - 8	If you are looking for a program that keeps you up with new innovative solutions for the power network of the future, this course is for you. Learn about the challenges and solutions for frequency control, voltage control, simulations, and monitoring.	RWTH Aachen University	July 2020	Sept 2020	Ph.D. Students, Masters Students	CC BY-SA-ND
 Innovation and Diversity in Engineering	7 - 8	The course deals with the context between the development of sustainable innovations and diversity and with the question of how culture shapes and impacts engineering	RWTH Aachen University	July 2020	Sept 2020	Ph.D. Students, Masters Students	CC BY-SA-ND
	6 -	Renewable energy sources	Università di Napoli	Feb 2020	Mar 2020	Students in engineering	CC BY-

 Renewable Energy Technologies	7	play a key role in the transition toward a zero-carbon society: by 2050, they are expected to supply more than 2/3 of the global energy demand, strongly contributing to reducing greenhouse gas emissions and limiting the effects of global warming.	Federico II				SA-ND
 Electric heat pumps in the energy transition framework	6-7	An overview of electric heat pumps with a case based approach: data from the user, working principle and technologies, regulations, energy, and environmental impact indicators, sizing in a basic case and interaction with a real building, thermal energy storage technologies.	Università di Napoli Federico II	Feb 2020	Mar 2020	Students in engineering	CC BY-SA-ND
 Green professionalization and ethics	6-7	Professions are involved in and, somehow, transformed by the energy transition. New skills are required, both from the technical and social fields. These “green collars” have to deal with the institutionalizatio	Università di Napoli Federico II	Feb 2020	Mar 2020	Trainers, students, graduates, Ph.D. students and Ph.D. from Social science and from others discipline interested in Energy Transition dynamics; Public administrators, decision makers, and Third sector	CC BY-SA-ND

		n of the ecological values and the local knowledge of the territories.				exponents; All other individuals are interested in the topic and willing to promote participatory planning for sustainable ET.	
 Corporate Communicatio n and Corporate Social Responsibility	6 - 7	Today corporate social responsibility means environmental responsibility. Communicate the company's attention on sustainability is a relevant factor of success, but also a difficult challenge.	Università di Napoli Federico II	Feb 2020	Mar 2020	Trainers, students, graduates, Ph.D. students and Ph.D. from Social science and from other disciplines interested in Energy Transition dynamics; Public administrators, decision makers, and Third sector exponents; All other individuals are interested in the topic and willing to promote participatory planning for sustainable ET.	CC BY-SA-ND
 A holistic approach for Energy Transition: territory, networks, and sustainability	6 - 7	This course focuses on the socio-territorial and environmental perspectives in order to understand ET as the social construction process. We will address the concepts of sustainability and of participatory planning and their implications in	Università di Napoli Federico II	Feb 2020	Mar 2020	Trainers, students, graduates, Ph.D. students and Ph.D. from Social science and from others discipline interested in Energy Transition dynamics; Public administrators, decision makers, and Third sector exponents; All other individuals are	CC BY-SA-ND

		terms of cooperation/conflict.				interested in the topic and willing to promote participatory planning for sustainable ET.	
 New Materials for solar cells applications	6-8	What is unique in this lesson? Solar cell types comparison!! A new presentation of commercial thin-film solar cells technology Slides – attractive videos and tests for the student.	University of West Attica	Feb 2020	Mar 2020		CC BY-SA-ND
 Energy and environment	6-7	The MOOC aims to give an overview and the knowledge for the interconnection of the production and consumption of energy with the environment under the context of the energy transition.	University of West Attica	Feb 2020	Mar 2020		CC BY-SA-ND

Table 20: Pilot Phase MOOC Delivery Timelines

		M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
Course	**Duration**		**First Course Block**														
UNIWA																	
New Materials for solar cells applications	6 weeks	**PRODUCTION**	**Launch**	**Enrolment**	**Start**		**End**				**1st Course Block reiteration**						
Energy and environment	6 weeks		**Launch**	**Enrolment**	**Start**		**End**										
UNINA																	
Renewable Energy Technologies	8 weeks	**PRODUCTION**						**Launch**		**Enrolment**	**Start**		**End**		**1st Course Block reiteration**		
Electric heat pumps in the energy transition framework	9 weeks							**Launch**		**Enrolment**	**Start**		**End**				
Green professionalization and ethics	6 weeks	**PRODUCTION**	**Launch**	**Enrolment**	**Start**	**End**					**1st Course Block reiteration**						
Corporate Communication and Corporate Social Responsibility	6 weeks		**Launch**	**Enrolment**	**Start**	**End**											
An holistic approach for Energy Transition: territory, networks and sustainability	6 weeks		**Launch**	**Enrolment**	**Start**	**End**											
OTEA																	
Train the trainers	6 weeks	**PRODUCTION**		**Launch**	**Enrolment**	**start**	**End**				**1st Course Block reiteration**						
UPV																	
Hydrogen as Energy Vector	6 weeks	**PRODUCTION**	**Launch**	**Enrolment**	**start**	**End**											
RWTH			**Second Course Block**														
Challenges and solutions in Future Power Networks	8 weeks		**Launch**	**PRODUCTION**				**enrolment**		**enrolment**	**start**	**End**		**2sd Course Block Reiteration**			
Innovation and Diversity in Engineering	8 weeks		**Launch**					**enrolment**		**enrolment**	**start**	**End**					
AAU																	
An Introduction to AC Microgrids for Energy Control and Management	6 weeks		**Launch**	**PRODUCTION**				**enrolment**		**enrolment**	**start**	**End**		**2sd Course Block Reiteration**			
An Introduction to DC Microgrids for Energy Control and Management	6 weeks		**Launch**					**enrolment**		**enrolment**	**start**	**End**					
Optimization Strategies and Energy Management Systems	6 weeks		**Launch**					**enrolment**		**enrolment**	**start**	**End**					
Maritime Microgrids – A Sustainable Solution for Green Sea Transportation	6 weeks		**Launch**					**enrolment**		**enrolment**	**start**	**End**					
Power Quality Challenges and Solutions for Microgrids	6 weeks		**Launch**					**enrolment**		**enrolment**	**start**	**End**					

Figure 2: MOOC Delivery Gantt Chart

2.6 Key Actions for MOOC Programme Deployment

The key actions required for MOOC programme deployment are detailed in the tables below that include participation and keen involvement from all the partners.

2.6.1 Step1: Involving key partners and stakeholders

Involving Key Partners			
Aim	**Action**	**Expected result**	**Period**
1. Partnership with other EU projects	1. Each partner to identify at least three target bodies 2. Writing a formal letter of collaboration agreement (AAU)	Identification and establishment of visible links of ASSET with other projects and networks of interest.	M12-M24
2. Involvement of Energy companies	Letter of invitation Webinar organization	Provide prospective learners	M12-M24
3. Involvement of the University and Research center	Each partner introduces MOOCs in their own research centers	Intensify research involvement and new course development based upon the center participation	M12-M24
4. Involvement of Digital learning and IT center at the partner universities	Each partner involves their university's digital learning center for university wide adoption.	University wide adoption and expansion of ASSET learning contents	M12-M24

Table 21: List of actions to involve key partners and stakeholders

2.6.2 Step 2: Getting to know the ASSET educational offer

Getting to know the ASSET educational offer			
Aim	**Action**	**Expected result**	**Period**

Inform and creating awareness around energy transition opportunities	Provide and elaborate complete and comprehensive information about Asset Educational Offer	Engage students	M12-M24
Creating a series of impact messages to circulate about ASSET educational offer and reasons why it has not to be missed	MOOC book	Engage citizens	M12-M24

Table 22: List of actions to disseminate ASSET educational offer

2.6.3 Step3: Attracting users to ASSET educational offer

Attracting users to the ASSET educational offer			
Aim	**Action**	**Expected result**	**Period**
The first action aims at assisting consortium partners in pedagogy choices, instructional design, and available educational tools. Webinars are dedicated also to reach a specific target group of stakeholders able to multiplier the ASSET scopes	the ASSET Webinar Series	Create a community of interested people in energy transition and in the ASSET offer as well	M12-M24
External stakeholders are informed and involved in the ASSET ecosystem	the ASSET Summer School	Involve stakeholders and policy makers in a joint workshop for best practice and policy indication in the field	M12-M24
Gathering and manage non-partner proposal to use ASSET MOOC Offer	the Request for MOOC use	Introduce some agreements in order to exploit the ASSET offer after the project end	M12-M24

Table 23: List of action to attract users

2.7 User monitoring and MOOC programme assessment strategy

Learning analytics, together with social survey data, constitute one part of the ASSET platform evaluation. Monitoring activities are mandatory for the ASSET project as described in T2.4 “Monitoring tools”. In order to have data to reflect and improve on, we ask that all MOOC providers commit and collaborate with our use of learning analytics as well as commit and collaborate with our use of the survey tools which are offered.

For the MOOC facilitators a retrospective analysis is provided:

- About the different groups of learners. Learners will be divided into groups depending on their activities (or lack of them): enrolled (enrolled only, in the course), observers (entered the course more than five times), contributors (added to page visits, used also posts, comments or submitted content in the course context at least once) and active users (learner contributed to the course more than five times)
- About discussion initiators and responders with the aim to investigate whether the participants tend more to initiate discussions or, they just follow other posts and reply to the questions
- Overview of time spent and the number of interactions on different lessons. Such information will provide an overview of what lessons are more intensively visited and which assignments are submitted by the participants
- For the MOOC facilitators, there is a dashboard with the following information: number of interactions and time spent on different lessons: how many assignments accessed and submitted, number of visits on different learning content (texts, hyperlinks, additional learning resources)

Social survey data are collected by the means of questionnaires developed ad hoc. Surveys are oriented to obtain data on individual MOOCs and will normally consist of three steps, relaying two types of feedback:

- Step 1 is about collecting data on people enrolled in a course --- potential participants --- and concentrating on their expectations and their profile. A link to the questionnaire is proposed to each person who enrols in a MOOC
- Step 2 is about collecting reactions after the experience when learners have had the chance to interact with the course features, tools, and materials. Not-enrolled people are monitored with an ad-hoc designed questionnaire as well
- Step 3 is about focusing on very specific needs during the MOOC delivery (i.e. observing gender participation to education in energy transition; detecting energy workers' needs or the approach of the young generation, etc.). At last, a mini survey will be settled for the special cluster of teachers/tutors in order to reflect on their satisfaction with the programme results and the whole Asset offer

The first set of data, obtained after a first iteration, will enable the MOOC provider: teacher(s), tutor(s) to know more about their audience. The information will serve as a platform for reflection to the MOOC creators and when a second iteration is prepared, changes can be considered and integrated into it. The same process can be applied to the analysis of the second set of data, which will be more about satisfaction both at an overall level and in the detail, concerning a MOOC specific topic, its features, tools, materials, as well as special target-groups observation, etc.

3. Classroom and blended short programmes

3.1 Deployment concept

One of the key outcomes of the ASSET project is to offer research, innovation and educational services that are developed by the educational actors and delivered to the energy sector, companies, academia, businesses, and society. The educational services intend to involve all the actors that can contribute to fuel interdisciplinary research combining engineering and SSH disciplines, therefore, they are capable of reaching out to the society to produce an upskilled energy transition relevant human resource and a new generation of energy-sensitive citizens that are part of the energy transition mission.

Energy transition towards a low-carbon society is a complex multidisciplinary and multi-sectoral challenge and requires contributions from all sectors of life. Moreover, it requires a highly skilled human resource equipped with sound knowledge, vast exposure and hands-on experience for tackling the complex multidisciplinary energy challenges of the 21st century. In order to address the multidimensionality of the challenge at hand, classroom and blended short programmes are designed to provide cutting-edge, interdisciplinary, education at the interface of disciplines ranging from social sciences, humanities, engineering, and technology. The delivery of these courses will not only train the university students for career opportunities in the field of energy rather they will also serve as a platform for the industries to train their employees for the emerging energy challenges.

The deployment concept for classroom based short and blended programmes are different from MOOCs concept, as MOOCs are generally designed for an open and wide range of audiences. However, classroom programmes are specifically designed to address the knowledge-skills- competencies (KSC) required for the energy transition and for continuous resource pooling to efficiently educate/train large numbers of people in diverse and interdisciplinary topics and carry out research and innovation activities. The target audience mainly include a) employees from energy companies that are already working in the field of energy transition and are interested to upgrade/upskill their education, skills, and competencies for the dynamically changing energy scenarios, and b) the university students ranging from undergraduate, graduate and postgraduate levels including doctoral candidates, who are directly connected to the field of energy and aspire to peruse their career in the area of energy transition.

The assessment of KSC for energy transition and a bottom up approach for educational material development using the ASSET learning graph tool are the inherent characteristics of these programmes, which not only enable meaningful educational program delivery but also offer a replicability and reusability feature to enhance the impact and sustainability of these offerings.

3.1.1 Courses delivery for lifelong learning

Short programmes in the form of classroom courses, university programmes and seminars on the topics identified through research, innovation, and education (RIE) needs, along with KSC assessment will be prepared through the ASSET learning graph tool. These programmes intend to be delivered to the target audiences that will primarily be the employees of the energy companies related to the ASSET consortium as well as professionals outside the ASSET consortium that will attend ASSET summer schools. More importantly, these programmes are designed such that industry professionals will be able to have hands-on training for their specific field of the energy transition. The employees of energy companies will register and attend these courses in the ASSET universities according to their respective offerings. The industrial courses and seminars are specifically designed to target these employees and for lifelong learning, as a semester long courses are generally not suitable for them. For instance, the courses offered by Aalborg University (AAU) that are of high industrial relevance are designed as a two to three-day courses for industrial participants. Also, the short courses offered by other partners in the form of seminars and training are suitable for employees of energy companies.

The main concept behind the lifelong learning short programmes is to define means for the collaborative identification of educational/ training needs between academia and industry. The process is not just limited to identification; rather delivery of these programmes will help to sustain the energy transition in two directions, a) the industrial actors can train/upskill their employees according to the most recent and advanced trends in the area of energy, and b) educational actors leverage the participation of the employees of industry and energy companies to benchmark their curriculum and course contents according to the practical needs of the industry. The modular nature of these programmes and the way they are designed will impart a replicability/reuse potential to the learning materials for their utilization in multiple energy scenarios across various industries. This way, a set of employees from a certain energy company, trained through the ASSET short courses will be able to disseminate the learned practices and contents to fellow colleagues in their respective energy companies in a comprehensive and effective manner.

Therefore, the involvement of employees of energy companies of the ASSET ecosystem in life learning programmes will help defining an energy-transition oriented vocabulary for describing the KSC and learning elements relevant to the energy transition and more specifically relevant to technology, innovation, entrepreneurship, social sciences and combinations among them towards interdisciplinary programme creation.

3.1.2 Course delivery to University Students

Short programmes in the form of classroom courses, university programmes and seminars on the topics identified through research, innovation, and education (RIE) needs along with KSC assessment will be prepared through the ASSET learning graph tool. Other than lifelong learning as described earlier, these programmes will also be delivered to target audiences that include the students of the Universities included in ASSET as well as students from universities of the ASSET ecosystem. The main concept behind the creation and delivery of these programmes to university students is to prepare them for evolving market needs and competencies needed for the energy transition. The idea is to facilitate and significantly accelerate the creation of new and update current programmes along with their replication from the universities and training actors to match the continuously evolving energy market needs.

Since the energy transition is a multidisciplinary and multi-sectoral challenge and requires an understanding of almost all sectors ranging from social science and humanities to business communication and analytics as well as engineering technology. Therefore, one of the key focus behind the development of these programmes is to adopt an interdisciplinary approach, to enhance and foster the interdisciplinary competencies highly in need to be developed among the labor market and potential future employees of the energy companies.

All short programmes are designed to contain case-based learning (CBL) modules to allow participants to apply the knowledge learned in the lessons to the real world and into practical scenarios, thereby enhancing their exposure to the multidisciplinary energy challenges. Learning by doing approach will enable university students to boost their confidence and aspirations in the field of energy and above all the inclusion of laboratory-based practical exercises will impart them practical exposure and hand-on training preparing them as a useful resource for the energy companies and energy industries.

Overall, these programmes specifically designed for university students at all possible levels of learning, from undergraduate to graduate and postgraduate levels will provide cutting-edge, interdisciplinary, education at the interface of disciplines ranging from social sciences, humanities, engineering, and technology. The successful delivery of these programmes and associated learning/ training of students will, therefore, generate a highly skilled human resource equipped with sound knowledge, vast exposure and hands-on experience for tackling the complex multidisciplinary energy challenges.

3.2 Deployment strategy

The deployment strategy for classroom based short programmes including courses, seminars, and blended programmes follows the ASSET learning graph approach to ensure that the deployment is in accordance with the concept presented in the above section. In addition, the strategy ensures that the key characteristics of ASSET, including state of the art RIE needs, and KSC are addressed. Moreover, the scalability of the learning material and associated programmes are also ensured to guarantee the sustainability and reusability of the approach as well as contents. Mainly three different modes of classroom based short program delivery are adopted i.e. a) short courses and seminars, b) short course with lab-based training exercises, and c) blended courses. The development strategy of these modes is detailed below.

3.2.1 Short courses/programmes selection

The programmes are prepared based upon the KSC needed for the energy transition. The KSC assessment is based upon the methodology discussed in D2.1 and D2.2. Based upon the required KSC, and learning objectives, a learning graph-based model is adopted for course development as discussed in detail in D2.3 “Learning goals catalogue for the energy sector“and D3.1 “Learning Graphs”. This systematic approach for the program and their contents selection is discussed below:

In order to assess the knowledge and educational needs to cope up with the societal challenges in the energy sector, the quantitative and qualitative analysis has been performed to investigate two focus areas, a) the policy frameworks of energy transitions, b) green professions and educational needs. The target groups for the broad assessment mainly include:

- Market and customers
- Industrial networks
- Policy and Administration
- Infrastructure managing agencies/authorities
- Cultural agencies
- Science and technological actors

The assessment of the focus areas is based upon the questionnaires, focus groups and in-depth interviews of the relevant stakeholder categories using multilayer ethnographic research methodology. Particular attention is paid to determining the role of the experts, professionals and institutional actors in fostering energy transitions. More importantly, the mismatch between the profile of experts and the actual skills requested by the energy transition is investigated. The details of the research questions, challenges, adopted methodology, stakeholder categories, and the conclusions are detailed in D2.1 “Research design on societal aspects related to energy transition - methodology & data collection”. The main outcomes and findings of the designed research are:

- Societal challenges related to the energy transition, social awareness, local cooperation and/or conflict.
- Existing knowledge, skills and professionalization of the experts operating in the field of the energy transition.
- The mismatch between the competencies' profile of experts and actual skills required on the ground of energy transition projects (training needs).

These findings are further linked to the assessment of the skills shortage and training needs in the area of the energy transition. A double track approach is adopted to identify the skill needs required from the labor market in the multiple areas cross-related to the transformations associated with the energy transition to a low-carbon society and to tackle skills gaps as well as skills mismatches. The double track approach consists of a) carrying out an extensive review of well-established national studies focused on the KSCs related to the energy transition and b) undertaking a desk analysis with the first aim to identify the most innovative technologies correlated with the clean energy transition. From the implementation of the double-track approach, technologically important areas of energy research and innovation are identified, mainly:

- Energy Efficiency (EE)
- Renewables Integration
- Smart Grids and Energy Systems

D2.2 “Report on RIE needs related to energy transition“details the review findings and provides information on educational and vocational training needs, including key competences induced by the on-going energy transition to a low-carbon economy. Also, it highlights detailed analysis and findings for “KSC needs and RIE gaps” which identifies the gaps between Knowledge, Skill and Competence's needs and interprets them to RIE needs taking into account the available educational programmes. Since energy transition requires input and efforts from multiple sectors, therefore, information and data about cross-sectoral skill shortages for ICT professionals, e-Leadership and Key Enabling Technologies (KETs) are also found using the approach discussed in D2.2.

Based on the identified KSC needs and RIE gaps, the learning goal catalogue for energy transition is defined. The details of the learning graph model adopted for ASSET programmes in terms of learning topics and learning outcomes are discussed in D2.3. The adopted learning graph concept not only maps the KSC and RIE need to the learning outcomes of ASSET programmes, but its scalable and flexible approach also allows educational actors to expedite the program preparation and delivery phases with the further possibility of reusing the material for new programmes development. These programmes can either be interdisciplinary or on-demand courses requested by other energy companies for the training of their employees.

For the classroom based blended and short programmes, the following modes are selected for the initial delivery and deployment. These programmes address five fields: the field of Social Sciences and Business Development beside the fields of Renewable Energy, Energy storage and the field of Smart and Flexible Energy Systems.

3.2.1.1 Short courses and seminars

For classroom-based learning offers under the ASSET umbrella, most of the partner universities will adopt face-to-face short courses/seminars as a primary mode of delivery. These short courses will vary in their range from various EQF levels, duration and target audience including undergraduate, graduate and postgraduate students. Additionally, in some of the class-based short courses and seminars, industry professionals and employees of energy companies will also participate. In this mode of delivery, the instructor will teach the students through the predefined learning materials and provide instructions within specified lecture timings. The learning materials mainly include presentation and PPT slides along with some key readings from the literature, state-of-the –art papers and findings from their own research. The ASSET learning graph tool approach will allow the instructors to upgrade their teaching materials as well as building new courses/programmes according to the changing requirements and directions of energy transformations. The emphasis of all of these courses will be on the case-based learning where students in the form of groups or individuals will be assigned case exercises for enhancing the level of learning as well as reinforcing their link with the practical energy transition related issues in our daily life. The following table shows the details of the class based short course/seminars that will be delivered during the ASSET project lifetime. Generally, seminars will be of limited duration and focused on specialized topics, while courses vary from a duration of semester to a few days based in line with the academic policies and offering of the department of various universities involved within the ASSET consortium.

No.	ASSET Courses	Form	Host Institution

1	Power Quality in Microgrids	Course	AAU
2	DC Microgrids	Course	AAU
3	Maritime Microgrids	Course	AAU
4	Power Systems Dynamics	Course	RWTH
5	Monitoring and distributed control for power systems	Course	RWTH
6	Implementation of automation functions for monitoring and control	Course / Practicum	RWTH
7	Case study on distributed grid operation	Seminar	RWTH
8	Multi-terminal DC grids	Seminar	RWTH
9	Optimization Strategies and Energy Management Systems	Course	AAU
10	AC Microgrids	Course	AAU
11	Hydrogen as energy vector	Course	UPV
12	New Materials for solar cells applications	Course	UNIWA
13	Renewable Energy Technologies[1]	Seminar about MOOC	UNINA
14	Electrical heat pumps in the energy transition framework[2]	Seminar about MOOC	UNINA
15	Corporate and institutional communication and Social Responsibility	Seminar about MOOC	UNINA
16	Green professionalization and ethics	Seminar about MOOC	UNINA
17	Participatory planning tools and Social network analysis[3]	Seminar about MOOC	UNINA

18	Innovation processes in the energy sector	Seminar	OTEA
19	Energy Efficient and Ecological Design of Products and Equipment	Course	UNIWA
20	Energy and environment	Course	UNIWA
21	SF6 Technology and Handling in Electricity Grids	Seminar	UNIWA
22	Energy communities implementation in industrial parks	Seminar	UNIWA
23	Understanding Responsibility in research and Innovation	Seminar	RWTH
24	Economics of energy sources and the optimal integration of renewable energies and energy conservation measures	Seminar	LS
25	Behavioral change as a powerful drive to minimize energy consumption while providing the same level of energy service	Seminar	LS

Table 24: List of class-based short courses/seminars

1. Previously titled “Energy Integration of Renewable Sources to District Heating, Cooling and Power Systems” in the DOA

2. Previously titled “Heat pump technology for smart production of heating and cooling using renewable sources” in the DOA

3. Previously titled “Socio Technical Analysis” in the DOA.

3.2.1.2 Lab-based training / hands-on experience

The hands-on experience and lab-based training allow participants to have practical exposure to the material studied in the course and to grasp the hardware implementation challenges. In addition, this training will familiarize the students with some practical tools and knowledge they can directly apply in industries and energy companies. For the employees of energy companies, this will give them a first-hand experience of the state-of-the-art research facilities.

ASSET will exploit the infrastructures available in the universities of its consortium to offer training through hands-on experience in three different courses to 60 people in total. Namely,

RWTH is equipped with a real-time simulation laboratory that is routinely used in teaching for demonstrating concepts and operation of modern power systems and controls. The learners are both students and employees of E.ON. or other companies. It has developed and holds (though publicly available) the software for realizing the interconnection between different infrastructures. In ASSET, RWTH will develop the missing interfaces to create a hands-on environment for a Praktikum (hands-on course) on substation automation based on standard IEC61850. This course will be offered to a group of 10 people from the ASSET community in the framework of the ASSET project.

This course focuses on the implementation of the automation based on the standard series IEC61850. After an introduction to the main concepts of the standard and of the digital substation, the students

will learn the Substation Configuration Language file structure, the IED capability description, configuration and instantiation, the System Specification Description and the Substation configuration description. At the end of the module, students are able to understand and apply the basics of IEC61850, to configure and integrate intelligent electronic devices for monitoring, distribution and protection functions and to validate the IED and substation configuration. This course has the structure of a "Praktikum" in the German system, that it is a "hands-on" course. The students will program the IEDs, which in turn will acquire measurements and control from the virtual domain of real time simulation. This course is intended for students and industry professionals. This prakticum is planned to be deployed initially between April and July of 2020. Later, it will be offered to a group of 10 people from the ASSET community between October of 2020 and February of 2021.

At **AAU**, the most important facilities relevant to ASSET are the AC Microgrid Research Lab, the DC Microgrid Research lab and the recently built IoT Microgrid living. AAU will use this world-class proof-on-concept which facilitates the real-time control, operation, and optimal energy management of renewable energy integration together with energy storage systems and consumption. AAU will use this powerful experimental-research-oriented environment, to offer training to one group of 10 students and another group of 10 engineers from the industry.

This training will be provided to 10 students and 10 industrial participants of AC and DC microgrid courses to be offered at the department of energy technology during their regular courses in April 2021 during the second year iteration of the class-based course offerings at AAU.

Furthermore, the **University of West Attica** will exploit the infrastructure of its High Voltage and Power Systems Research Lab to offer 2 days training of 20 workers in the Greek Energy Industry on a programme that the members of the community will define.

3.2.1.3 Blended programmes

Blended programmes and blended mode of delivery correspond to the usage of both class-based face-to-face teaching and MOOCs simultaneously for extended levels of learning. The instructors simultaneously use online material and class-based teaching to cover the learning materials. In some cases, instructors post some content through the MOOC platform to cover the pre-requisites of a certain topic so that students come to class prepared for the advance topic to be discussed in the class. In other cases, online materials are used for case-based exercises and assessment of the material taught within the class. Nevertheless, this mode allows extended participation and enhanced interaction between class participants and the instructor. The following programmes will be offered in the blended mode using both MOOCs and class-based face-to-face teaching under the ASSET.

No.	ASSET Courses	EQF	Form	Host Institution
1	Case stud on distribution grid operation	6-7	Blended (Seminar + Online)	RWTH
2	Monitoring and distributed control for power systems	6-7	Blended (Seminar + Online)	RWTH
3	Hydrogen as an energy vector	6-7	Blended (Course + MOOC)	UPV

Table 25: List of blended short programmes

3.3 Learning material development and reusability

The program selection and development is based upon the KSC and RIE needs in the area needed for energy transition and is assessed through the methodologies discussed in D2.1 “Research design on societal aspects related to energy transition - methodology & data collection”, D2.2 “Report on RIE needs related to energy transition”. ASSET considers that to accelerate educational programme design and delivery, we have to pursue the reuse of not only materials but also whole structures. For this reason, it adopts the learning graph model [1] that has been used in the H2020 MaTHiSiS project for different learning environments and use cases. According to this model, any learning experience is broken down into learning goals and each learning goal to a number of learning atoms that in real life can be implemented through a variety of alternative learning materials. Once the targeted EQF level, the targeted audiences, and the targeted learning/delivery mode (e.g. fully structured, face-to-face, online, blended, etc.) are defined, the tutor defines an instance of the learning graph. ASSET considers that if we define a common “Energy Transition Educational vocabulary”, then the exchange of learning components is straightforward.

Each partner university offering courses was involved to create the learning material and learning graphs in multiple phases. First, the learning graph model for the Energy Transition and the ASSET vocabulary was defined. The definition of the learning graph model provides the template for describing learning offers (ASSET and beyond), which is the basis for implementing the learning graph tool in WP3 (“Energy Transition Programme Preparation”). The model consists of the fields learning topic, learning outcomes and learning material, each organized in specific attributes. The ASSET vocabulary defines the set of learning outcomes, and the related terminology, based on existing taxonomies. This step is key to 1) identify the learning graph model for the ASSET courses, 2) integrate future learning offers from the ASSET Community in a consistent way, and 3) support replicability in other topic areas.

Learning outcomes for each course were defined based upon the KSC mapping and using the bloom’s taxonomy [2].

The sample learning graph containing the learning objective and learning material for one of the ASSET courses is shown below. The detailed compilations regarding all the ASSET offerings are available in D2.3 “Learning goals catalogue for the energy sector”.

Educational Programme Title	**DC Microgrids**
SET Area	1) integrating renewable technologies in the energy system 2) new technologies and services for consumers 3) resilience and security of energy systems 4) New materials and technologies for buildings
EQF level	Level 7-8
Learning outcomes	● Recognize the importance of DC Microgrids as a reliable, resilient and efficient technology for the integration, distribution, and utilization of renewable/non-renewable based generation and storage resources ● Illustrate various architectures, configurations and applications of DC Microgrids at the residential, commercial and industrial level

	• Examine various control schemes on the individual power electronic converters for DC microgrids • Examine various control schemes on the parallel converters for DC microgrids • Apply various layers of hierarchical control including primary, secondary and tertiary control for DC microgrids
Other relevant keywords	Integration of DC Distributed Generation, DC Distribution, HVDC for Transmission

Table 26: DC Microgrids

Learning Outcome	Definition/explanation of the Learning Outcome	Learning Materials
Recognize the importance of DC Microgrids as a reliable, resilient and efficient technology for the integration, distribution, and utilization of renewable/non-renewable generation resources	• Distributed Renewable/Non-renewable Energy Resources • Overview of Microgrid Technology • Microgrid Configurations and Examples	(1 set of slides, 2readings)
Illustrate various architectures, configurations and applications of DC Microgrids at the residential, commercial and industrial level	• Current war • DC Microgrids configurations • DC Microgrids at home • DC Microgrids facilities	(1 set of slides, 3 readings)
Examine various control schemes on the individual power electronic converters for DC microgrids	• Feedback linearization control • One cycle control • Buck converter • Half-bridge with synchronous rectifiers • Half-bridge current doubler rectifier	(1 set of slides, 3 readings, 2Lab handouts, and 2 simulation exercises)
Examine various control schemes on the parallel converters for DC microgrids	• Parallel control schemes • Centralized control • Master-slave control	(1 set of slides, 4 readings, 1 Lab handouts, and 1 simulation exercise)

Learning Outcome	Definition/explanation of the Learning Outcome	Learning Materials
	• Averaged control • Droop control • Virtual impedance • Adaptive voltage positioning (AVP)	
Apply various layers of hierarchical control including primary, secondary and tertiary control for DC microgrids	• Voltage droop: Primary control • Secondary control • Secondary control for DC Microgrids • Tertiary control for DC Microgrids • Clusters of DC Microgrids	(1 set of slides, 3 readings, 3 Lab handout, and 3 simulation exercises)

Table 27: Learning outcomes and learning materials description: DC Microgrids

For each course learning outcome, various learning materials in the form of video-based lessons, documents, and presentations, web-based materials like quizzes, simulation handouts, manuals, simulation exercises, case-based learning instances, etc. were defined. This learning graph strategy significantly accelerates the creation of single- and multi-disciplinary programmes, it supports all types of learning (formal, informal, blended, etc.), and maximizes learning component re-use. ASSET innovates in creating innovative forms and tools enabling resource pooling among universities.

The description of the learning material is collected and reported in D2.3, while D3.1 and D3.2 are dedicated to the development of learning material. D3.1, which is also being prepared side by side as its due date coincides with D4.2 due date. The sample of learning material for one of the ASSET offering courses and its reuse potential is shown below for the reference. The further details on learning material collection and compilation along with reuse potential can be found in the D3.1 report.

Next, the learning materials developed for the DC Microgrids course

Learning Material 1	
Short description or summary	Presentation (PPT) slides will be used to cover the following topics in detail. • Distributed Renewable/Non-renewable Energy Resources • Overview of Microgrid Technology • Microgrid Configurations and Examples
Targeted EQF level	• 7-8
The targeted learning/delivery mode	• Face to Face

Learning Material 1	
(e.g. face to face, online, blended etc.	
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	● PPT
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 2	
Short description or summary	Microgrid configuration example from the demonstration Project in Hachinohe: Microgrid with Private Distribution Line
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further reading online
The targeted audiences	PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://ieeexplore.ieee.org/document/4304276?arnumber=4304276
Author & organisation	Kojima, Y. Koshio, M. Nakamura, S. Maejima, H. Fujioka, Y. Goda, T.A, Mitsubishi Electric Corp. Amagasaki, Hyogo, Japan

Learning Material 3	
Short description or summary	An overview and summary of real world microgrids
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online

Learning Material 3	
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://ieeexplore.ieee.org/abstract/document/4304255
Author & organisation	Barnes, M. Kondoh, J. Asano, H. Oyarzabal, J. Ventakaramanan, G. Lasseter, R. Hatziargyriou, N. Green, T. School of Electrical and Electronic Engineering, University of Manchester, UK

Learning Material 4	
Short description or summary	Presentation (PPT) slides will be used to cover the following topics in details. ● AC and DC Current war ● DC Microgrids configurations ● DC Microgrids at home and residential buildings ● DC Microgrids facilities
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PPT
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 5	
Short description or summary	The impact of voltage level and DC distribution architecture on the performance and efficiency of a data center

Learning Material 5	
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://ieeexplore.ieee.org/abstract/document/4448733
Author & organisation	Annabelle Pratt ; Pavan Kumar ; Tomm V. Aldridge Corporate Technology Group, Intel Corporation, Hillsboro, Oregon, USA

Learning Material 6	
Short description or summary	Overview of the architecture of residential microgrids with the case studies of Japanese residential microgrid
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://ieeexplore.ieee.org/abstract/document/5587899
Author & organisation	Hiroaki Kakigano; Yushi Miura; Toshifumi Ise Osaka University, Osaka, Japan

Learning Material 7	
Short description or summary	DC distribution microgrids based on modular photovoltaic modules and battery storage

Learning Material 7	
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online ttps://ieeexplore.ieee.org/document/4304276?arnumber=4304276
Author & organisation	Kai Sun, Tsinghua University, Beijing, China Li Zhang, Yan Xing, University of Aeronautics and Astronatutics, Nanjing, China Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 8	
Short description or summary	Presentation (PPT) slides will be used to cover the following topics in details. ● Feedback linearization control ● One cycle control ● Buck converter ● Half-bridge with synchronous rectifiers ● Half-bridge current doubler rectifier
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PPT

Learning Material 8	
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 9	
Short description or summary	Switching flow graph models and one cycle control techniques for PWM switched power electronic converters
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online http://thesis.library.caltech.edu/2476
Author & organisation	Smedley, Keyue Ma California Institute of Technology, USA

Learning Material 10	
Short description or summary	Control of DC Microgrid converters with the emphasis on the control of half-bridge synchronous rectifier.
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF https://ieeexplore.ieee.org/abstract/document/1137507

Learning Material 10	
Author & organisation	L. Garcia de Vicuna, Univ. Politecnica de Catalunya, Vilanova, Spain Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 11	
Short description or summary	Design of Simple feedback linearizing controller to reduce audio susceptibility and load disturbance in the full-bridge current doubler synchronous rectifier
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://ieeexplore.ieee.org/abstract/document/1453042
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark & Sustainable Distributed Generation Syst. & Renewable Energy Group, Escola Univ. d'Enginyeria Tecnica Ind. de Barcelona, Spain.

Learning Material 12	
Short description or summary	Design of control parameters for DC microgrids: The objective of this simulation handout is to guide the student to achieve AC current and DC voltage control for a DC microgrid. And also, droop controller for load current sharing is designed. This also serves as the basis of CBL learning as a specific design exercise based upon learning material 12 will be given in learning material 13.
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants

Learning Material 12	
Format and link to the material (if publicly available)	PDF
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 13	
Short description or summary	Based on the learning material 12, two simulation exercise tasks will be given in this learning material and a guide Matlab coding file (.m) will be provided where Matlab rlocus, margin, bandwidth commands are used for designing the controller parameters.
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	Matlab File (.m)
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 14	
Short description or summary	Simulation Evaluation of Stand-alone Converter with DC Voltage Control: The objective of this simulation handout is to guide the student to test the designed control of a DC microgrid including DC current droop control. The student will see DC voltage deviation by using the virtual impedance. This also serves as the basis of CBL learning as a specific design exercise based upon learning material 14 will be given in learning material 15. The learning material 14 will provide a step-by-step guide to perform these tasks.
Targeted EQF level	● 7-8
The targeted learning/delivery mode	● Face to Face

Learning Material 14	
(e.g. face to face, online, blended etc.	
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 15	
Short description or summary	Based on the learning material 14, two simulation exercise tasks will be given in this learning material and a guide Matlab model file (.slx, .mdl) will be provided where a) DC bus voltage forming by parallel rectifiers, and b) Proportional current sharing by parallel rectifiers will be designed by the students. The learning material 14 will provide a step-by-step guide to perform these tasks.
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	Matlab File (.slx, .mdl)
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 16	
Short description or summary	Presentation (PPT) slides will be used to cover the following topics in detail. ● Parallel control schemes ● Centralized control ● Master-slave control

Learning Material 16	
	• Averaged control • Droop control • Virtual impedance
Targeted EQF level	• 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended, etc.	• Face to Face
The targeted audiences	• PhD/Industrial Participants
Format and link to the material (if publicly available)	PPT

Learning Material 17	
Short description or summary	Modelling and Design for a Novel Adaptive Voltage Positioning (AVP) Scheme for Multiphase VRMs
Targeted EQF level	• 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	• Discussed face to face in class • Further Reading Online
The targeted audiences	• PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://ieeexplore.ieee.org/abstract/document/4558239
Author & organisation	Martin Lee ; Dan Chen ; Kevin Huang ; Chih-Wen Liu ; Ben Tai Taiwan University, Taipei

Learning Material 18	
Short description or summary	Comparative study and discussions of hysteretic controllers for single-phase voltage regulators used in low-voltage applications

Learning Material 18	
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://digital-library.theiet.org/content/journals/10.1049/iet-pel_20070151
Author & organisation	M. Castilla; J.M. Guerrero; J. Matas; J. Miret; J. Sosa Department of Electronic Engineering, Universitat Politècnica de Catalunya, Spain (Primary author's affiliation)

Learning Material 19	
Short description or summary	Control of parallel-connected bidirectional AC-DC converters in stationary frame for microgrid applications
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://ieeexplore.ieee.org/abstract/document/6064335
Author & organisation	Xiaonan Lu; Josep Guerrero; Remus Teodorescu; Tamas Kerekes; Kai Sun; Lipei Huang State Key Lab of Power Systems, Department of Electrical Engineering, Tsinghua University, Beijing, China (Primary author's affiliation)

Learning Material 20	
Short description or summary	Distributed Control to Ensure Proportional Load Sharing and Improve Voltage Regulation in Low Voltage DC Microgrids
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://ieeexplore.ieee.org/abstract/document/4558239
Author & organisation	Sandeep Anand; Baylon G. Fernandes; Indian Institute of Technology Bombay, Mumbai, India Josep M. Guerrero, AAU, Denmark

Learning Material 21	
Short description or summary	Control design of a standalone voltage-droop regulated dc microgrid: This material is focused on the coordinated tuning of control parameters of a multi-source DC Microgrid. At first, the student will learn how to use the state-space technique for modeling the coupled differential equations that represent particular elements of the DC MG. Then, these equations will be linked to assembling the state-space model of the general N-unit system. Impact analysis of changing virtual-resistance is performed for both configurations, as this control parameter has an influence on stability. This will also serve as the basis of CBL for the simulation exercise tasks presented in learning material 22.
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants

Learning Material 21	
Format and link to the material (if publicly available)	PDF
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 22	
Short description or summary	Based on the learning material 21, four simulation exercise tasks will be given in this learning material and a guide matlab model/Simulink file (.mdl, or xls) will be provided where students have to design simulations for the following cases. 1) Construction of the one-unit state-space model and tuning the parameters of inner control loops 2) Droop impact analysis on system stability 3) Common voltage control by 4 paralleled sources 4) Analysis of secondary control for restoring the common voltage deviation
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	Matlab File (.mdl, xls)
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 23	
Short description or summary	Presentation (PPT) slides will be used to cover the following topics in details. ● Voltage droop: Primary control ● Secondary control ● Secondary control for DC Microgrids

Learning Material 23	
	● Tertiary control for DC Microgrids ● Clusters of DC Microgrids
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PPT

Learning Material 24	
Short description or summary	Hierarchical Control of Droop-Controlled AC and DC Microgrids—A General Approach Toward Standardization
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://ieeexplore.ieee.org/document/5546958
Author & organisation	Josep M. Guerrero ; Juan C. Vasquez; José Matas; Luis García de Vicuna ; Miguel Castilla Department of Automatic Control Systems and Computer Engineering, Universitat Politècnica de Catalunya, Barcelona, Spain AAU, Denmark

Learning Material 25	
Short description or summary	Hierarchical Control for Multiple DC-Microgrids Clusters based upon distributed SOC and consensus based secondary control
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://ieeexplore.ieee.org/abstract/document/6939722
Author & organisation	Qobad Shafiee ; Tomislav Dragičević ; Juan C. Vasquez ; Josep M. Guerrero Aalborg University, Aalborg, East, Denmark

Learning Material 26	
Short description or summary	Hierarchical control of power plants with microgrid operation
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Discussed face to face in class ● Further Reading Online
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF, Online https://ieeexplore.ieee.org/document/5674954
Author & organisation	Josep M. Guerrero, AAU, Denmark

Learning Material 27	
Short description or summary	Design of hierarchical control for dc microgrids: The objective of this learning module is to guide the student to achieve each control level of a hierarchical control system. Previously designed local AC current, DC voltage and droop controllers are for the primary control level. A secondary controller for restoring the DC voltage and tertiary controller for DC grid current regulation will be reached in this learning material. This will also serve as the basis of CBL for the simulation exercise tasks presented in learning material 28.
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 28	
Short description or summary	Based on the learning material 27, two simulation exercise tasks will be given in this learning material and a guide Matlab model/Simulink file (.mdl, or xls) will be provided where students have to design simulations for the following cases. 1) Design secondary controller 2) Design tertiary controller
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	Matlab File (.mdl, xls)

Learning Material 28	
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 29	
Short description or summary	Evaluation of hierarchical control for dc microgrids: The aim of this learning material is to guide the student to test the designed hierarchical control system of a DC microgrid, including the primary, secondary and tertiary control levels. The student will see DC voltage deviation and restore them to nominal values by means of a secondary control strategy and the DC grid-connected current control by means of a tertiary control strategy. This will also serve as the basis of CBL for the simulation exercise tasks presented in learning material 30.
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 30	
Short description or summary	Based on the learning material 29, two simulation exercise tasks will be given in this learning material and a guide Matlab model/Simulink file (.mdl, or xls) will be provided where students have to design simulations for the following cases. 1) Secondary control to restore DC voltage in the microgrid 2) Tertiary control to control the DC-side grid-connected current in the microgrid
Targeted EQF level	● 7-8

Learning Material 30	
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Particirpants
Format and link to the material (if publicly available)	Matlab File (.mdl, xls)
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 31	
Short description or summary	Balancing by using a knowledge based fuzzy inference system: The main aim of this learning material exercise is to completely understand how the virtual resistance can be used in order to adjust the power sharing in an islanded DC microgrid with distributed energy storage systems. The virtual resistance can be adjusted in order to balance the stored energy between distributed energy storage systems. Commonly, several different gain-scheduling approaches have been proposed in order to achieve a balance between distributed energy storage systems. Particularly, in this learning material, a simple strategy based on an intuitive knowledge base fuzzy system will be proposed for equalizing the state of charge of distributed energy storage systems based on batteries. This will also serve as the basis of CBL for the simulation exercise tasks presented in learning material 32.
Targeted EQF level	● 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended etc.	● Face to Face
The targeted audiences	● PhD/Industrial Participants
Format and link to the material (if publicly available)	PDF
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

Learning Material 32	
Short description or summary	Based on the learning material 31, two simulation exercise tasks will be given in this learning material and a guide Matlab model/Simulink file (.mdl, or xls) will be provided where students have to design simulations for the following cases. 1) Manual Adjustment of weight coefficients for SoC equalization. 2) Task 2: Fuzzy adjustment of weight coefficient for automatic equalization.
Targeted EQF level	• 7-8
The targeted learning/delivery mode (e.g. face to face, online, blended, etc.	• Face to Face
The targeted audiences	• PhD/Industrial Participants
Format and link to the material (if publicly available)	Matlab File (.mdl, xls)
Author & organisation	Josep M. Guerrero, Aalborg University, Denmark.

- The short programmes will be delivered in the energy technology department of Aalborg University, Denmark to the Ph.D. students. The number of participants range from 25-30 for this course.
- Additionally, some Ph.D. students from Aalborg University, Esbjerg campus will also join this course.
- Parts of it as a tentative interdisciplinary PhD/industrial seminar together with the department Energy Technology for Sustainable Development of UPV and the department of Electrical and Electronic Engineering of University of West Attica
- As a supplement, some of the modules/learning materials can be used in Challenges and solutions in Future Power Networks (Form: MOOC for Industry and PhD/MSc students and Monitoring and distributed control for power systems (Form: course for Industry and PhD/MSc students) to the RWTH courses

3.4 Timelines for programme delivery and delivery activities

The timelines for the classroom based short programmes and blended programmes delivery including the details of instructors, host institution/department offering the courses, planned dates of delivery, target audience and mode of delivery are shown in the Table below. It may be noted that the delivery dates are aligned according to the departmental/institutional course routines of course offering.

No	Program	Instructors	University	Department	Delivery Dates	EQF	Target Audience	Delivery Activity
1	Power Quality in Microgrids	Alexander Micallef Mehdi Savaghebi Saeed Golestan	AAU	Energy Technology	MAY 13-15, 2020	7-8	Ph.D./ Industrial	Course
2	DC Microgrids	Josep M. Guerrero Baoze Wei	AAU	Energy Technology	MAY 6-7, 2020	7-8	Ph.D./ Industrial	Course
3	Maritime Microgrids	Josep M. Guerrero Tomasz Tarasiuk, Giorgio Sulligoi, Daniele Bosich	AAU	Energy Technology	MAY 2-3, 2020	7-8	Ph.D./ Industrial	Course
4	Power Systems Dynamics	Antonello Monti	RWTH	ACS	06 Apr - 17 July 2020	6-7	M.S.	Course
5	Monitoring and distributed control for power systems	Ferdinanda Ponci	RWTH	ACS	06 Apr - 17 July 2020	6-7	M.S.	Course
6	Implementation of automation functions for monitoring and control	Ferdinanda Ponci	RWTH	ACS	12 Oct 2020 – 05 Feb 2021	7-8	M.S./ Industry	Course/Lab
7	Case study on distribution grid operation	Ferdinanda Ponci	RWTH	ACS	Fall 2020	6-7	M.S.	Blended (Seminar + Online)

8	Multi-terminal DC grids	Ferdinanda Ponci	RWTH	ACS	Fall 2020	6-7	M.S.	Blended (Seminar + Online)
9	Optimization Strategies and Energy Management Systems	Moisès Graells Eleonora Riva Sanseverino Emilio J. Palacios-Garcia	AAU	Energy Technology	APRIL 22-24, 2020	7-8	Ph.D./ Industrial	Course
10	AC Microgrids	Josep M. Guerrero Ernane A. Coelho Yajuan Guan	AAU	Energy Technology	MAY 4-5, 2020	7-8	Ph.D./ Industrial	Course
11	Hydrogen as energy vector	Carlos Sanchez Díaz	UPV	Institute for Energy Engineering	APRIL 21-June 11, 2020	7	Master	Course
12	New Materials for solar cells applications	Theodore Ganetsos Kyriaki Kiskira	UNIWA	Department of Industrial Design and Production Engineering	23/3/20 TO 25/5/20	6-8	Prograduated/ Master/ Ph.D./ Industrial	Course
13	Renewable Energy Technologies [1]	Massimo Dentice D'accadia	UNINA	industrial engineering	15 april 2020, 20 may 2020	6-7	Student/ pregraduate/graduate	Seminar about MOOC
14	Electrical Heat Pumps in Energy Transition Framework 2	Nicola Bianco	UNINA	industrial engineering	15 april 2020, 20 June 2020	6-7	Student/ pregraduate/graduate	Seminar about MOOC
15	Corporate and institutional communication and Social Responsibility	Ivano scotti	UNINA	Social Science	15 april 2020, 20 may 2020	6-7	Student/ pregraduate/graduate	Seminar about MOOC

16	Green professionalization and ethics	Dario Minervini	UNINA	Social Science	15 april 2020, 20 may 2020	6-7	Student/ pregraduate/graduate	Seminar about MOOC
17	Participatory Planning Tools and Social Network Analysis 3	Anna Maria Zaccaria	UNINA	Social Science	15 april 2020, 20 may 2020	6-7	Student/ pregraduate/graduate	Seminar about MOOC
18	Innovation processes in the smart energy sector	Katerina Dima	OTEA		Within 12 months	6	Employees from the Energy Sector	Seminar
19	Energy Efficient and Ecological Design of Products and Equipment	Constantinos S. Psomopoulos	UWA	Electrical and Electronics Engineering Department	Oct2020-Dec2020	7-8	Master/ Ph.D./ Industrial	Course
20	Energy and Environment	Constantinos S. Psomopoulos	UWA	Electrical and Electronics Engineering Department	March 3, June 12, 2020	6-8	Pregraduated/ Master/ Ph.D./ Industrial	Course
21	SF6 Technology and Handling in Electricity Grids	Constantinos S. Psomopoulos	UWA	High Voltage and Energy Systems Lab of EEE	June 2020		Electricians in Transmission and Distribution Grids	Seminar
22	Energy communities implementation in Industrial Parks	Constantinos S. Psomopoulos	UWA	High Voltage and Energy Systems Lab of EEE	November 2020		Workers / Owners/ Operators of Industrial Parks	Seminar
23	Understanding Responsibility	Ana de la Varga	RWTH	Human Technology	May-June	7-8	Ph.D.candidates/	Seminar

	in research and Innovation			Center	2020		Postdoc	
24	Economics of energy sources and the optimal integration of renewable energies and energy conservation measures	Walter Cariani	LS		May-June 2020	6-8	Pregraduated/ Master/ Ph.D./ Industrial	Seminar
25	Behavioral change as a powerful drive to minimize the energy consumption while providing the same level of energy service	Antonio Disi Rino Romani	ENEA LS	Energy efficiency Technical unit	Oct 2020	6-8	Pregraduated/ Master/ Ph.D./ Industrial	Seminar

Table 28: Classroom-based programmes delivery timelines

For the assessment of these courses, questionnaire will be used as detailed in the D2.4 monitoring tool to see the satisfactory performance of the programmes in its delivery phase.

4. Interdisciplinary short programmes

4.1 Deployment concept

ASSET consortium has recognized and set the focus of its activities the creation and delivery of interdisciplinary educational/training programmes. Furthermore, we believe and will assess how the ASSET learning models and tools facilitate the creation of such programmes.

To do this, we have decided to work on the following directions:

- Professors who belong to the ASSET team members create interdisciplinary courses
- Professors outside the ASSET team create interdisciplinary courses
- Agree and organize interdisciplinary Master programmes and Ph.D. positions/thesis

In principle, in ASSET we consider two different cases:

- The case where a completely new interdisciplinary educational programme needs to be created. In this case, a new programme is created adopting the learning graph model and tool. For example, RWTH has planned to create such a course.
- The case where professors/trainers are interested in enriching their current educational programmes injecting seeds from other disciplines. For example, UNIWA is interested in including learning outcomes relevant to innovation processes and social sciences in currently offered educational programmes.

To facilitate this interdisciplinary programme creation, we adopt the following steps (methodology) in the framework of ASSET:

Step 1: All interested professors/trainers study what is available as topics and learning outcomes in the ASSET educational programme portfolio (see D3.1) to identify the learning outcomes that could be combined with the educational programme they are currently offering.

Step 2: Professors/trainers willing to include learning outcomes developed by others, study the available materials and may contact their creators for further advice. The issue that arises here is that a person cannot become an expert in multiple disciplines just by studying a few learning materials. The ASSET professors/trainers have defined three ways to address this issue:

- Use the introductory part of another educational programme after communicating with the relevant professor to get valuable insights,
- Invite the professor to give some lectures to their audience exploiting available mobility opportunities
- Explore the case of prompting the students/trainees to follow a MOOC where support from experts is provided.

4.2 Definition and creation of programmes in ASSET

	Creator	**Involved Disciplines**	**Combining 1st phase of materials**	**Target audience**
1	UNIWA, P. Karkazis	ICT and Innovation thinking	YES	Postgraduate UNIWA students
2	UNIWA, N. Leligou	ICT and Diversity	YES	Undergraduate UNIWA students

3	UNIWA, T. Ganetsos	Material and Responsible Research	YES	Undergraduate and post graduate UNIWA students
4	UNIWA, C.S. Psomopoulos	Ecological and Energy Efficient approach and thinking	YES	Undergraduate and post graduate UNIWA students
5	RWTH	Electrical Engineering & SSH	NO	Undergraduate/postgr aduate students

Table 29: Interdisciplinary programmes

4.2.1 Interdisciplinary educational programme 1

This Educational Program consists of one module with the description of one use case in the energy transition area, which is used to illustrate the challenges of responsibility in research and innovation.

This Educational Programme is interdisciplinary between the Engineering Topics and the Humanities Topics.

This Programme achieves the following ASSET learning outcomes:

- List and explain the challenges of future power systems
- Examine the concept of responsibility in research and innovation

The course will be planned, the structure of the material will be created based on the maximum re-use of the ASSET material.

4.2.2 Interdisciplinary Educational Programme 2

In the educational programme currently offered at UNIWA (not through ASSET) titled “Software Defined Networks”, two learning outcomes from the ASSET programme “Innovation processes in the energy sector” will be included:

- Understand Innovation Processes
- To familiarise with Growth Mindset

As the course “Innovation processes in the energy sector” is offered as MOOC, it will be explored how to combine with the post-graduate course. A blended approach is currently considered more suitable.

4.2.3 Interdisciplinary Educational Programme 3

In the educational programme currently offered at UNIWA (not through ASSET) titled “mobile app development”, two learning outcomes from the ASSET programme “Innovation and Diversity in engineering” will be included:

- explain and compare different gender and diversity approaches
- discuss the context between diversity and innovation

To do so, once the learning materials will be developed, the professors will meet to create a better understanding of creating an interdisciplinary course.

4.2.4 Interdisciplinary Educational programme 4

In the educational programme currently offered at UNIWA titled “New Materials for solar cell applications”, one learning outcome from the ASSET programme “Understanding Responsibility in

Research and Innovation" will be included: Examine the concept of responsibility in research and innovation.

To do so, once the learning materials will be developed, the professors will meet to create a better understanding of creating an interdisciplinary course.

ASSET partners consider that this approach will allow them to create a better understanding of the diverse disciplines among themselves, which will result in combined Master and Ph.D. Thesis. RWTH and UNIWA have already initiated such discussions.

4.3 Definition and Creation of Programmes outside ASSET Team

For the creation of interdisciplinary courses by professors outside the ASSET team members, the main pathway is to organize workshops so as to invite other professors to try and do the exercise of creating an interdisciplinary course. We anticipate that once we let them experience what they can do they will be interested in embracing the approach in a sustainable manner.

During these workshops we will:

- Present ASSET learning graph Model
- Discuss the importance of interdisciplinarity in our economies and market
- Present the ASSET educational programmes portfolio
- Prompt them to check which learning outcomes they would be interested in
- Ask them to define their own learning models including ASSET learning outcomes (on-site)
- Provide feedback and assess the ASSET offerings

Two workshops are currently foreseen:

- In the framework of the ITS conference (https://its2020.iis-international.org/)
- Workshop in UNIWA inviting people from other Greek Universities

4.4 Timeline for programme delivery

	Creator	Involved Disciplines	Combining 1st phase of materials
1	RWTH	Electrical Engineering & SSH	Only course design
2	UNIWA, P. Karkazis	ICT and Innovation thinking	Spring 2020
3	UNIWA, N. Leligou	ICT and Diversity	Winter 2020
4	UNIWA, T. Ganetsos	Material and Responsible Research	Winter 2020

Table 30: Time plan for interdisciplinary program delivery

5. On-demand educational programmes

5.1 Deployment concept

The creation and deployment of two educational programmes on demand aim to showcase that the ASSET ecosystem and platform boost competence creation. The deployment will proceed as follows:

1. The energy companies within the ASSET consortium and three companies from the ASSET ecosystem (two candidates willing to experience this pathway have already been identified E.ON/Germany and Protergia/Greece) will provide the requirements for two programmes.
2. Based on the requirements, the universities of the ASSET consortium will design the two educational programmes.
3. The universities of the ASSET consortium will deliver the programmes to the companies that suggested the programme.
4. Finally, all actors involved in the programme creation and design will be asked to fill in questionnaires for evaluation.

5.2 Programme specification through communication to the industry and Relevant Universities

5.2.1 Selection of Industry Partners

The energy companies inside the ASSET consortium, namely, Logical Soft SRL (LS) and ECOPOWER, participate in the creation and deployment of educational programmes on demand. In addition, three companies from the ASSET ecosystem are participating as well. These three companies will be selected using the following criteria:

- Companies must be interested in having their employees trained
- The employees must be available for the training during the project duration

A strong commitment from the companies and employees is an important factor for selecting the participants.

5.2.2 Requirements Specification

The companies will identify the following parameters for the program creation:

- Mode of delivery (e.g. MOOC, blended learning, seminar)
- Duration
- Learning outcomes
- Date of delivery
- Number of participants

For identifying the learning outcomes, the companies will use the ASSET Marketplace and will select the learning outcomes among those available in the ASSET courses. New learning outcomes will be defined in case the desired ones are not covered in any of the existing ASSET programmes. ASSET Partners will support the company representatives in using the tools and formulating their requests. The feedback on this process will be part of the outcome of this activity. In person meetings and telcos will be arranged as necessary.

5.2.3 University selection for course creation

After receiving the target learning outcomes for the two programmes, the ASSET universities will consult to agree on the finalization of course format, material and delivery details:

The delivery of the programmes will be finalized based on the availability of participants and instructors and laboratory wherever necessary.

5.3 Learning Material Development

The material from existing ASSET programmes is expected to be sufficient and in any case, will be reused as much as possible in the delivery of on-demand programmes. The material will be identified with the help of the ASSET Marketplace and the Learning Graph Tool. In case the material is not yet covered in any of the existing ASSET programmes, then the teacher, who is going to use the material, will be asked to create it.

5.4 Time Plan for Programme Delivery

The process of designing the programmes will start in May 2020. By this time, the first version of the ASSET material is available to partners, and the mapping with the learning outcomes in the Learning Graph Tool. Below is the timeline for the programme creation and delivery:

1. May 2020
    - Reach out to the companies in the ASSET ecosystem, explaining tools in ASSET and the ASSET courses
    - Identification of participating companies
2. 1st half of June 2020
    - Establishment of the requirements of the two ASSET programmes on demand
3. 2nd half of June 2020 to December 2020
    - Time-window where the materials will be prepared and the programmes are expected to be delivered to companies
    - An initial assessment of the experience in programme creation, and possibly delivery, will be prepared by September 2020 for D4.4
4. July 2020 to February 2020
    - Time-window where programmes can be assessed by all participants
5. The final assessment of the experience in programme creation and delivery will be prepared by March 2021 for D4.5

6. Conclusion

The material provided in this deliverable describes the deployment plan including deployment concept, deployment strategy, and classification of educational offers provided by ASSET. The courses offered under the asset umbrella are classified as a) Massive open online courses (MOOCS), b) classroom-based short and blended programmes, c) interdisciplinary courses, and d) on-demand industry courses. The methodology for learning material development and the delivery activities for each course category has been detailed. The deliverable also details the preliminary schedule for the delivery activities and mode of delivery for each course. The assessment of educational offers using questionnaires and EMMA platform assessment tools are also described. The deliverable material will be used to keep a track of all the deployment process and streamlining all the delivery activities throughout the ASSET project lifetime.

7. References

[1] N.V. a. P. D. D. Tsatsou, “Modelling Learning Experiences in adaptive multi-agent learning environments,” in 9th Int. Conference on Virtual Worlds and Games for Serious Applications, Athens, Greece, 2017.

[2] D. Kennedy, Writing and using learning outcomes: a practical guide., University College Cork, 2006.

ANNEX – Preparing a MOOC on EMMA

Form A. MOOC proposal for the EMMA platform

GENERAL INFO	
Name of MOOC	
Providing Institution	
Description (outline of lessons if possible, summary syllabus)	
Duration in Weeks	
Total workload in hours (course + homework)	
Course format (text--based syllabus, pre--recorded videos, live webinars, podcasts, presentations, discussions etc.)	
Language of Delivery	
Preferred languages to translate to	
Teachers + short bio	
OTHER DETAILS	
Accreditation Possible from the University?	

Any examples online of (similar) course?	
Target type of participant	

Conditions participants/ prior knowledge needed?	
License (CC/ all rights protected)	
Special Needs (eg. support)	
CONTACT PERSON	
Name	
email address	

Form B. MOOC Description

Item	to complete (English)	to complete (your one language)	Guidance
Title of MOOC			Please use 10 words or less and try to make the title as attractive and inviting as possible in your own language
MOOC teaser text			Be comprehensive, use an appealing language to attract students, offer a future perspective. Please use a max of 60 words, focus on: - what is unique about your MOOC, - what is most attractive about it and - why it is relevant for your target audience

Item	to complete (English)	Guidance

Name of person completing this form		This should be the person who is the first point of contact for this MOOC, please include name, email address and mobile phone
Available languages	EN	Please use the relevant language code: EN/ES/IT/ etc
Availability of intro video (Date)		All MOOCS have to have available a short introduction video, welcoming potential participants which should then be subtitled in all relevant languages. Please indicate when you have this ready and send us the video.
Enrolment start date		Please indicate the date when the enrolment will be opened on the platform.
Start date MOOC		Please indicate the date when this MOOC will start.
Duration		Please state the duration in weeks of this MOOC .
Promotional contact		Please provide the name and contact details of the person in your institution responsible for promoting this MOOC, please include name, email address and mobile phone.
Delivery contact		Please provide the name and contact details of the person in your institution responsible for the academic contents and delivery of this MOOC, please include name, email address and mobile phone.

Form C. MOOC SYLLABUS

Course Title	
To be publish __/__/__	Author and Coauthors:

Closing date __/__/__	
Overview	
Learning Objectives	
Outcomes	

LESSON 1 TITLE	Date _____/_____/_____
Learning Objectives	
UNIT 1 TITLE	
Content	
Tags	
Assignment n.	Quiz n.
Peer assessment	
UNIT 2 TITLE	
Content	
Tags:	
Assignment n.	Quiz n.
Peer assessment	

UNIT 3 TITLE	
Content	
Tags:	
Assignment n.	Quiz n.
Peer assessment	

PEDAGOGICAL TOOLS (YES/NO)
Study materials
Blog post Dissemination/Communication
Virtual classroom
Conversation tool

LESSON 2 TITLE	Date _____/_____/_____
Learning Objectives	
UNIT 1 TITLE	
Content	
Tags:	
Assignment n.	Quiz n.
Peer assessment	Yes/No

UNIT 2 TITLE	
Content	
Tags:	
Assignment n.	Quiz n.
Peer assessment	Yes/No
UNIT 3 TITLE	
Content	
Tags:	
Assignment n.	Quiz n.
Peer assessment	

PEDAGOGICAL TOOLS (YES/NO)
Study materials
Blog post Dissemination/Communication
Virtual classroom
Conversation tool