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Education for Digitalization of Energy

Deliverable 6.2

Intermediate report on the field tests

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Abstract:

This report will describe the content of the piloting activities for each field test site and update the deployment plan. In addition, the connection to the overall Blueprint Strategy of the piloting activities will be drawn.

Keywords:

D6.1, D6.2. piloting activities, field test, D5.3, activity content, BSDE

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	Participant organisation name	Short	Country
01	UNIVERSIDAD PONTIFICIA COMILLAS	COMILLAS	Spain
02	NATIONAL TECHNICAL UNIVERSITY OF ATHENS	NTUA	Greece
03	RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE	RWTH	Germany
04	FOSS Research Centre for Sustainable Energy – U. of Cyprus	FOSS	Cyprus
05	Politecnico di Milano – METID	POLIMI	Italy
06	Kungliga Tekniska Högskolan	KTH	Sweden
07	Fundación Obra Social y Monte de Piedad de Madrid – Escuelas Profesionales Padre Piquer	PIQUER	Spain
08	Centrul Roman al Energiei	CRE	Romania
09	REPSOL SA	REPSOL	Spain
10	IBERDROLA	IBERDROLA	Spain
11	GE Energy Products France SNC	GE	France
12	DNV-GL	DNVGL	Spain
13	EDSO for Smart Grids	E.DSO	Belgium
15	NOVEL Group	NOVEL	Luxembourg
16	University of Cologne Executive School	UCES	Germany
17	Institute of Energy Economics at the University of Cologne	EWI	Germany

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Definitions, Acronyms and Abbreviations

ACS – Institute for Automation of complex Power Systems

BSDE – Blueprint Strategy for the Digitalisation of Energy

EQF – European Qualifications Framework

EWI – Institute of Energy Economics at the University of Cologne

LEGOS – Lite Emulator of Grid Operations

LEM – Local Energy Markets

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Executive Summary

Energy sector's digitalisation process creates not merely several crucial challenges, but also great opportunities towards energy efficiency and sustainability. To take advantage of this opportunity, personnel with skills essential for this transformation is needed. EDDIE purpose is to develop an industry-driven Blueprint Strategy that will identify and try to cover the skill demand in European Energy sector digitalisation.

The project aims to create new profiles of engineers, researchers and technicians, trained and familiar with the new technologies, tools and methods to support and improve the digitalisation of energy sector. Additionally, the educational and research sector will fit in the new era and be in the spotlight of synergies with industry, policy makers and other relevant actors in this procedure.

The roll-out of Blueprint Strategy for the Digitalisation of Energy (BSDE) will take place in a central pilot site in Aachen and four smaller-scale pilot sites in Germany (Cologne), Greece (Athens), Italy (Milano) and Spain (Madrid). This deliverable is an update of the deliverable D6.1 and focuses on pilot activities content and the relation to the BSDE. Therefore, the program template from deliverables D5.2 and D5.3 is used to describe each of the 17 piloting activities additional to the program content. This draws a direct relation to the WP5 and the Blueprint Strategy of EDDIE. However, other parts of WP5 are also linked to the piloting activities. Various pilot activities that contain suitable training material will be placed in the Marketplace platform of the BSDE, developed in the context of EDDIE. Also, the identified trends in occupations related to the digital transformation of the energy sector in WP5 are being utilised in the design process of the pilot activities, targeting skills relating to these specific occupations. Besides the described relation to the central WP5, there are further links to the other work packages of the project. So, for example, the content development of the piloting activities will be affiliated to the skill needs and skill gaps identified in WP2. The stakeholder analysis of WP3 allows the pilot designers to define the educational content, based on the stakeholders' needs and reach out to the relevant stakeholders of each pilot activity. Lastly, the experiences of best practices in education, in the area of energy efficiency & transition, industrial transition & digitalization, as gathered in WP4, provide valuable insights regarding methodology, content, target groups and learning techniques.

The central pilot in Aachen will include learners from all EQF levels, proposing various activities. As the leader of the pilot is RWTH Aachen University, some of the actions focus on the education sector, from a workshop at a secondary school to actions for university students. These activities will include lectures and a summer school about modern power systems and digitalisation, as well as the dissemination of EDDIE project's material and Blueprint, targeting not only students in the field of electrical engineering but also all students in an interdisciplinary setting. Other activities are aiming to raise synergies and appeal to a larger audience, the central pilot in Aachen plans workshops and experimental demonstrations in cooperation with the local communities and nationwide events. These activities are targeting to raise awareness about renewable energy and digitalisation to a larger audience, including the young generation in dissemination events, a summer vacation program and Girl's Day. In the same direction, stands the partnership with the city of Herne to propose a workshop, based on smart city initiatives, in order to achieve dissemination of EDDIE scope to wider audience, focusing on energy applications.

In coordination with Aachen pilot site and in the context of the BSDE directions, four other pilot sites will be developed in Cologne, Athens, Milan and Madrid. The Cologne pilot site will be mainly industry driven, aiming to reduce skills gaps in energy sector. This includes a program to train employees on new trends in the energy sector, a certificate program for mastering the energy landscape of the future and a course connecting companies as teaching entities with students. The Greek pilot site focuses on lectures and courses to university students in the field of new tools and mechanisms that will play crucial role in the digitalisation of the energy system. To raise synergies, NTUA also plans to participate in a summer school and a MOOC, organized by the H2020 project ERIGrid 2.0, aiming to stress the necessity of updating education programs, in the context of the transformation of the energy sector. In Italy, Politecnico di Milano will develop a MOOC targeted to digital energy management for real estates, aiming to match green skills with the real estate sector. Finally, Piquer is setting up a complementary training module on automation technology to improve the energy efficiency and control the energy consumption in private households as an educational offer in vocational training (VET) in Spain.

The implementation of the activities will be followed by an assessment procedure, in order to measure the impact of the activities. The goal of the assessment is to achieve a continuous update of the Blueprint, and thus ensure the sustainability of the strategy, both during and after the end of the project. The end of this procedure will mean the determination of the Blueprint Strategy.

Overall, several of the elements of the BSDE are going to be tested through the pilots by assessing the possible impact they may have on the transition to the digital era of the energy system. In particular the skill gaps identified will be used as a starting point to develop educational material. In addition, the developed templates and best practice analysis will be utilized in the development process, while using the common language of syllabus elements that is being identified in WP5. The developed programs will be distributed and disseminated through the training programs marketplace and the dissemination portal of the BSDE.

1. Introduction

The digitalisation of the energy sector has a central role in the transition towards a sustainable future. The European Green Deal, along with other initiatives, positions the European Union as a global leader in this challenge. Europe has a unique opportunity to establish global leadership in the energy transition and to shape the future energy systems. Driven by technology innovations, as well as by the decarbonisation ambition set by the Paris Agreement and the EU 2050 target, this new architecture enables and supports increasing shares of renewables, energy storage and demand response management, all of which can increase grid flexibility.

The purpose of the EDDIE project is the foundation and establishment **of a Sector Skills Alliance to develop an industry-driven Blueprint Strategy for the education and training in the energy sector, which is continuously affected by digitalisation. This Blueprint is an industry-driven strategy that will meet and anticipate the skills' demands for the sustainable growth and digitalisation for the European Energy sector.** The ongoing digitalisation procedure of the energy sector causes major technological, economic and social challenges, creating new skills demands that need to be met in order to ensure the sustainable future of the energy sector. Providing adequate training and fostering cooperation among all stakeholders throughout Europe is vital towards that direction. Thus, the Blueprint strategy will establish a sustainable framework that allows to define and update educational programs responding to industry changes and to increase the attractiveness of the energy sector as a career choice. It will also take into consideration, in an interdisciplinary way, green and soft skills, social sciences humanities, economics and gender dimension.

All the effort implemented in WP2, WP4 and WP5, to identify the skills gaps in the Energy Sector and develop best practices and the Blueprint Strategy for the Digitalisation of Energy (BSDE), will be the roadmap for the design of the pilot demonstration activities. EDDIE's main target in WP6 is the BSDE rollout in different pilot demonstrators. Identifying and categorizing skill gaps and the corresponding job profiles is of high importance to determine the appropriate content and activities of the pilot sites. The piloting contents and activities will also consider and reflect the best practices identified and developed in WP4.

The main pilot will be deployed in the city of Aachen, including all courses and tools and focusing on addressing all the considered EQF levels and stakeholders. Pilot activities of smaller scale and more targeted EQF levels will also be deployed in Germany (Cologne), Greece (Athens), Italy (Milano) and Spain (Madrid). The implementation of these piloting activities will be followed by an assessment procedure, measuring the impact of the activities. The goal of the assessment is to continuously update the Blueprint, in order to ensure the sustainability of the strategy, both during and after the end of the project. In deliverable D6.1, there is a detailed description of the tools and measures of the assessment mechanism, along with the preliminary KPIs. The educational hubs, that will be created in WP3, will also play a role by monitoring the activities and providing feedback. As for the outputs and conclusions of the current WP, these will provide feedback for the update of the Blueprint, ensuring the strategy sustainability, both during and after the completion of the project and fostering the long-term and large-scale replication and continuous updating of the training programs.

All in all, the scope of this deliverable is the update from deliverable D6.1 and the description of the detailed content of the pilot activities. Besides, the connection to the BSDE is drawn by using the program template for the training marketplace of deliverable D5.3 to describe each pilot activity. With the application of this program template, the general information, business and operational model as well as the learning and teaching model of the pilot activity is described. In addition to this information, the focus is also on the presentation of the content of each pilot activity. Besides the connection to the BSDE with the individual completion of the program template, also the overall coherence of the pilot activities with the BSDE is explored.

1.1. Structure of the document

The integral part of this document consists of 4 remaining chapters. Chapter 2 presents the activities that will take place in the central pilot in Aachen, including an overview, a detailed description of the pilot activities by the program template of D5.3 and additional information, and a time schedule presented as a Gantt chart. Chapter 3 presents the smaller scale pilot sites in Germany (Cologne), Greece (Athens), Italy (Milano) and Spain (Madrid) following the presentation structure of the field test Aachen. Chapter 4 deals with the overall connection of the pilots with the blueprint strategy of EDDIE. Finally, in a conclusion the main points of the document are summarized.

1.2. Overview of Piloting Activities

In total there are 17 individual piloting activities distributed over different field test sites. Three out of the eight activities in Aachen either are in the implementation phase or have been completed. In Athens, there are four piloting activities organized by NTUA, while the field test site in Cologne has three activities supervised by EWI. Lastly, there is one activity in Milan and one in Madrid planned by POLIMI and PIQUER respectively. To get an overview, see the table below.

Table 1 Overview of piloting activities

Site	Partner	EQF Levels	Piloting activities
Aachen, Germany	RWTH	1-8	8 (3 in implementation)
Athens, Greece	NTUA	6-7	4
Milan, Italy	POLIMI	5-6	1
Cologne, Germany	EWI	4-6	3
Madrid, Spain	PIQUER	4	1
			Total 17

2. Status updates of field test Aachen

2.1. Field Test Aachen

The design and implementation of the Aachen pilot is being tailored to the needs of education/training providers and of the community (both governing bodies and citizens) in terms of (re)building knowledge, competence and skills, as identified in WP2 and related deliverables. The design and implementation also consider the rationale and the objectives of the Blueprint Strategy that is being developed in WP5. Consequently, several piloting activities have been conceived and planned, each addressing (and "testing") one or more components and aspects of the BSDE value chain.

The Institute for Automation of Complex Power Systems (ACS) of RWTH Aachen University delivers courses in BSc and MSc and participates in various EU-funded and regional programs. The piloting activities cover a range of EQF levels from 1 to 8. Thus, different target groups are addressed in order to increase knowledge, experience, and (re)skilling in the energy sector. It should be pointed out that the used program template from deliverable D5.3 to describe the piloting activities is developed for the EQF levels 4-8. Therefore, only the applicable parts of this program template are filled for the piloting activities with an EQF level of 1-3. Additional to the activities described in deliverable D6.1, the activity "Girl's Day at ACS" is appended to the piloting activities in Aachen. Furthermore, the content of the activities in comparison to deliverable D6.1 has been updated. Hence, the title of some activities has changed to describe the content more accurately.

2.1.1. Overview of activities

Table 2: Overview of activities at RWTH Aachen University

Target group	EQF Level	Timeline (from)	Activity	Main stakeholders	Part/s of Blueprint Strategy tested	Results delivered to EC	Energy (or other technological) sector	Contents
10-14 years, general public	1, 2	June '22	**Archimedischer Sandkasten with city of Aachen**	RWTH, Stadt Aachen, Bleiberger Fabrik	Levers to reduce skill gaps, Design of recommendations and overall action set, general templates, best practices	Teaching/learning material on renewable energy and Smart grid concepts	Power, IT	Introduction on topics related to smart grids, energy transition challenges and digitalisation, supported by practical demonstration. Tailored to kids.
High school students	2, 3	April '23	**Gymnasium Workshop**	RWTH, Anne Frank Gymnasium Aachen	Levers to reduce skill gaps, Design of recommendations and overall action set, general templates, best practices	Teaching/learning material on renewable energy and Smart grid concepts	Power, IT	Introduction on topics related to smart grids, energy transition challenges and digitalisation, supported by practical demonstration. Tailored to high school students and teachers.
Industry, municipality, citizens	3 to 8	April '23	**Workshop on Data Platforms for the Energy Infrastructure**	RWTH, Stadt Herne, Hochschule Bochum	Levers to raise awareness and to reduce skill gaps, Design of recommendations and overall action set, general templates, best practices	Computing tools and platforms	Power, IT	Workshops on open source data platform for smart cities

Bachelor students	6	June '23	**Summer School on smart electrical power systems**	RWTH Academy	Levers to reduce skill gaps, Design of recommendations and overall action set, general templates, best practices	Learning Outcomes, in terms of skills and knowledge, will be in line with ESCO and EQF frameworks	Power, IT	Summer school on Smart Electrical Power Systems
Bachelor students, Master students	6, 7	Dec '23	**Leonardo lecture on energy transition**	RWTH	Levers to reduce skill gaps, Design of recommendations and overall action set, general templates, best practices	Teaching/learning material on renewable energy and Smart grid concepts	Power, IT	Lecture on Digital Energy Revolution
Master students	7	Summer semester 2023 (from April '23)	**ACS lecture on automation of complex systems**	RWTH	Levers to reduce skill gaps, Design of recommendations and overall action set, general templates, best practices	Computing tools and platforms Learning Outcomes, in terms of skills and knowledge, will be in line with ESCO and EQF framework	Power, IT	Introductory course of current research topics in modern power systems, use of interactive computation sheets
High school students, Bachelor students, Master students, general public	3 to 8	11.11.2022	**Science Night at RWTH**	RWTH	Levers to raise awareness and to reduce skill gaps, Design of recommendations and overall action set, general templates, best practices	Teaching/learning material on renewable energy and Smart grid concepts	Power, IT	Introduction to digitalisation of the energy grid, energy grid demonstrator, dissemination events and material
10-14 years	1, 2	27.04.2023	**Girl's Day at ACS**	RWTH	Levers to reduce skill gaps, Design of recommendations and overall action set, general templates, best practices	Teaching/learning material on renewable energy and Smart grid concepts	Power, IT	Introduction on topics related to smart grids, energy transition challenges and digitalisation, supported by practical demonstration. Tailored to kids.

2.1.2. Description of activities

2.1.2.1. Archimedischer Sandkasten with city of Aachen

The “Archimedean Sandbox” event is a 3-week summer vacation program for school children from 10 to 16 years old organized by the city of Aachen and supervised by the local educational institution Bleiberger Fabrik in Aachen. Children can sign up for the program on individual days, weeks or the full period. Topic of the program is the energy generation through wind power. ACS is one of the technical supporters of the program next to other institutes of the RWTH. As a Kick-Off event, the children visit ACS on the first day and interact with a small wind park and energy grid model. This is a starting point for the children to design and build their own wind setup. ACS will consult the children in two meetings on their own wind setup project in the city center of Aachen. Furthermore, part of the program is an open fair for the general public. At this event, ACS presents the same wind park and energy grid model to interested pedestrians.

Program fact sheet

1. **Name of program:** Archimedischer Sandkasten
2. **Program format:** on-campus/ on-site
3. **Program language:** German
4. **Length of program:** 3 weeks
5. **Student´s estimated effort in working hours:** 3-30
6. **Industrial challenges addressed 1. - Economic and organizational:** N/A
7. **Industrial challenges addressed 2. – Social:** Acceptance of new technologies
8. **Industrial challenges addressed 3. - Technical and regulatory:** Technology integration (compatibility with existing processes/ technologies)
9. **Industrial challenges addressed 4. - Energy system:** N/A
10. **Industrial challenges addressed 5. - Extreme situations:** No
11. **Industrial challenges addressed 6. – Other:** Promoting young talent / labour shortage
12. **Skill gap area:** N/A
13. **ISCED code of program content:** 0713
14. **Starting point of program design:** Energy program with an ICT add-on
15. **Funding 1. - Available for free:** Yes
16. **Funding 2. - Types of funding:** Public funding
17. **Target groups:** Students (Pre-career stage)
18. **EQF level:** 1-2
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? No
    b. Does the program provide credits (ECTS)? No
    c. Is it modularized? No
    d. Does it provide any certification per module? No
20. **Certification:** N/A

Business and operational model

1. **Relevance of program:**
    a. **#1:** raising interest and awareness around the young generation, on modern power systems engineering and energy transition topics
    b. **#2:** Promoting young talent in engineering and IT professions
2. **Definition of targets:**
    a. Name the skills you target: electricity and energy
    b. Enter their ESCO codes: N/A
    c. Name the occupations you target: N/A
    d. Enter their ESCO codes: N/A
    e. Name the tools and systems that you target: N/A
3. **Financial structures: /**
4. **Use of resources:**
    a. **#1:** physical facilities at ACS, seminar room
    b. **#2:** research assistant from ACS as a lecturer
    c. **#3:** wind park and energy grid model
    d. **#4:** dissemination material
5. **Licenses for digital tools:** No
6. **Marketing and student recruiting procedures:**
    a. **#1:** Dissemination by the City of Aachen in the press
    b. **#2:** Dissemination by the City of Aachen in the Future Lab Forum
    c. **#3:** Dissemination at local schools
7. **Employer feedback:** N/A
8. **Alumni engagement:** N/A

Learning and teaching model

1. **Admission requirements:** No requirements
2. **Training goals:**
    a. Training goal #1: wind energy is not a constant energy producer due to weather dependencies
    b. Training goal #2: electricity supply and electricity demand in the energy grid must match
    c. Training goal #3: without conventional energy producers and volatile renewable energy sources in the energy grid of the future, energy storages are needed and the energy grid is getting complex
    d. Training goal #4: complex energy grid provides new challenges and needs new skills
    e. Training goal #5: Generate interest in STEM subjects and promote young talent
3. **Program content - Syllabus elements in ICT/ Digital:** N/A
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
    a. **#1:** BASIC ELECTRICITY – Electricity theory, Current, voltage & components
    b. **#2:** ELECTRICAL ENGINEERING – Power Plant (conventional and RES) Operation and Maintenance
5. **Program content - Syllabus elements in Energy:**
    a. **#1:** ENERGY MANAGEMENT & GREEN SKILLS – Energy Transition
    b. **#2:** ENERGY MANAGEMENT & GREEN SKILLS – RES (Solar Energy, wind energy)
    c. **#3:** ENERGY MANAGEMENT & GREEN SKILLS – Regulation & new Business Models
    d. **#4:** Electrical Engineering - configuration of RES Installations
    e. **#5:** Electrical Engineering - Electrical design
    f. **#6:** Electrical Engineering - Electrical engineering
6. **Program content - Syllabus elements in transversal skills:**
    a. **#1:** TRANSVERSAL PROFESSIONAL SKILLS –Teamwork
    b. **#2:** TRANSVERSAL PROFESSIONAL SKILLS – Problem solving
    c. **#3:** HUMANITIES & ETHICS – Critical thinking
    d. **#4:** HUMANITIES & ETHICS – Volunteering & cooperation
7. **Program content - Re-use of training modules:** Yes – Reuse of the landscape model for the Girl's Day at ACS
8. **Program content - Intellectual Property Rights:** All material are open to public**.**
9. **Methodologies:** Practical learning, Problem-based learning, Worked examples, Interactive lecture, Discussion-based learning
10. **Teaching methods:** Practical exercises, Problem solving
11. **Evaluation methods:** Other - no
12. **Internships:** No
13. **Scheduling:** Self-paced

Program Content

The main teaching object is the wind park and energy grid model, demonstrated to the participating children in the beginning of the vacation program at the ACS institute visit, and to the pedestrians during the dissemination event in the city center of Aachen. The model is a landscape, where small wind turbines can be plugged in at destined connection points. Also, part of the landscape are fixed capacitors representing energy storages and LED lights representing consumers. With the help of ventilators, wind is generated and directed on the wind turbines. Consequently, the LED lights are turned on. Based on the number of wind turbines and the rotation speed, the LED lights might fluctuate, which provides an understanding of the principle of load and generation. To stabilize the fluctuation, the energy storages can be activated, which explains the principle of energy storage. Additionally, the voltage can be observed in a voltmeter.

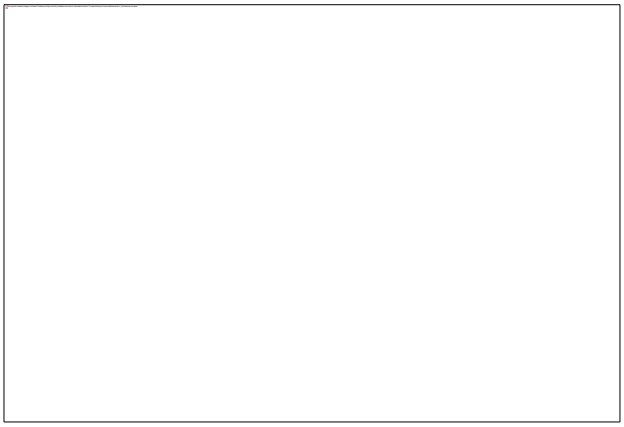


Figure 1: Picture of the model

2.1.2.2. Gymnasium Workshop

The Gymnasium Workshop is a two-day workshop in a STEM group at a Gymnasium in Aachen. Students should get a first understanding of digitalization in the energy sector. This is achieved through interactive presentations and the use of the Lite Emulator of Grid Operations (LEGOS) demonstrator.

Program fact sheet

1. **Name of program:** Gymnasium Workshop
2. **Program format:** On campus / On-site
3. **Program language:** German
4. **Length of program: 2 days** (22.03.2023, 29.03.2023)
5. **Student´s estimated effort in working hours:** 10 h
6. **Industrial challenges addressed 1. - Economic and organizational:** N/A
7. **Industrial challenges addressed 2. – Social:**
    a. **#1:** Lack of citizen engagement
8. **Industrial challenges addressed 3. - Technical and regulatory:**
    a. **#1:** Technology integration
9. **Industrial challenges addressed 4. - Energy system:**
    a. **#1:** Network operation – Automation and fault clearance
    b. **#2:** Network operation – Automatic fault indic**ators**
10. **Industrial challenges addressed 5. - Extreme situations:** No
11. **Industrial challenges addressed 6. – Other:** N/A
12. **Skill gap area:** Programming and development competence
13. **ISCED code of program content:** 0713 and 0714
14. **Starting point of program design:** Energy program with ICT add-on
15. **Funding 1. - Available for free:** Yes
16. **Funding 2. - Types of funding:** N/A
17. **Target groups:** Students (Pre-career stage)
18. **EQF level:** 2-3
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? No
    b. Does the program provide credits (ECTS)? No
    c. Is it modularized? NO
    d. Does it provide any certification per module? No
20. **Certification:** N/A

Business and operational model

1. **Relevance of program:**
    a. **#1:** Raising interest and awareness around the young generation, on modern power systems engineering and energy transition topics
    b. **#2:** Promoting young talent in engineering and IT professions
2. **Definition of targets:**
    a. Name the skills you target: energy and electricity
    b. Enter their ESCO codes: N/A
    c. Name the occupations you target: N/A
    d. Enter their ESCO codes: N/A
    e. Name the tools and systems that you target: N/A
3. **Financial structures:** N/A
4. **Use of resources:**
    a. **#1**: Lite Emulator of Grid Operations (LEGOS) Demonstrators
    b. **#2:** Whiteboard
    c. **#3:** Classroom at school
5. **Licenses for digital tools:** No
6. **Marketing and student recruiting procedures:**
    a. **#1:** Marketing via the Gymnasium
7. **Employer feedback:** N/A
8. **Alumni engagement:** N/A

Learning and teaching model

1. **Admission requirements:** No requirements
2. **Training goals:**
    a. Training goal #1: Generate interest in STEM subject
    b. Training goal #2: First introduction to the energy system
    c. Training goal #3: Introduction to the operation and issues of the energy grid
3. **Program content - Syllabus elements in ICT/ Digital:** N/A
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
    a. **#1:** CONTROL – Control systems
    b. **#2:** CONTROL – Distributed Control
5. **Program content - Syllabus elements in Energy:**
    a. **#1:** ELECTRICAL ENGINEERING - configuration of RES Installations
    b. **#2:** ELECTRICAL ENGINEERING – Electrical instrumentation
    c. **#3:** ELECTRICAL ENGINEERING - Electrical Substations
    d. **#4:** ELECTRICAL ENGINEERING - Electrical design
    e. **#5:** ELECTRICAL ENGINEERING - Electrical engineering
    f. **#6:** ELECTRICAL POWER SYTEMS – power plants, lines and substations
    g. **#7:** ELECTRICAL POWER SYTEMS – RES (Solar Energy, wind energy)
    h. **#8:** ENERGY MANAGEMENT & GREEN SKILLS - Energy transition
    i. **#9:** ENERGY MANAGEMENT & GREEN SKILLS – RES (Solar Energy, wind energy)
6. **Program content - Syllabus elements in transversal skills:**
    a. **#1:** TRANSVERSAL PROFESSIONAL SKILLS - Teamwork
    b. **#2:** HUMANITIES & ETHICS - Critical thinking
    c. **#3:** TRANVERSAL PROFESSIONAL SKILLS - Problem Solving
7. **Program content - Re-use of training modules:** Yes – Science night
8. **Program content - Intellectual Property Rights:** Material is open to public.
9. **Methodologies:** Practical learning, Interactive lecture, Discussion-based learning
10. **Teaching methods:** Practical exercises, Problem solving
11. **Evaluation methods:** No
12. **Internships:** No
13. **Scheduling:** Part-Time

Program Content

The Gymnasium Workshop is a two-day workshop in a STEM group at a Gymnasium in Aachen. In the first part of the workshop, the students familiarize themselves with the topics of energy transition and digitalisation by means of interactive lectures. Firstly, through an introduction to the topics of digitalisation and the energy transition itself. Subsequently, the students will work out together how digitalisation in the energy sector supports or enables the energy transition. This is done based on future strategies, such as load management or small island grids as DC-neighbourhood using IoT.

In a second part, the participants will have the chance to visually see the effects of small changes in the power grid using the Lite Emulator of Grid Operations (LEGOS) developed by RWTH. LEGOS is a multi-layered learning platform for demonstrating use cases of smart energy services. It consists of nodes that allow the connection of up to 6 branches and one unit (generator, consumer, storage, ...). Each branch is an active component that enables measurement and control of the energy flow between two units. The LED strips on the branches allow visualization of the magnitude and direction of the current flow through their activation patterns. Each unit can be controlled remotely through haptic interaction or as an IoT device.

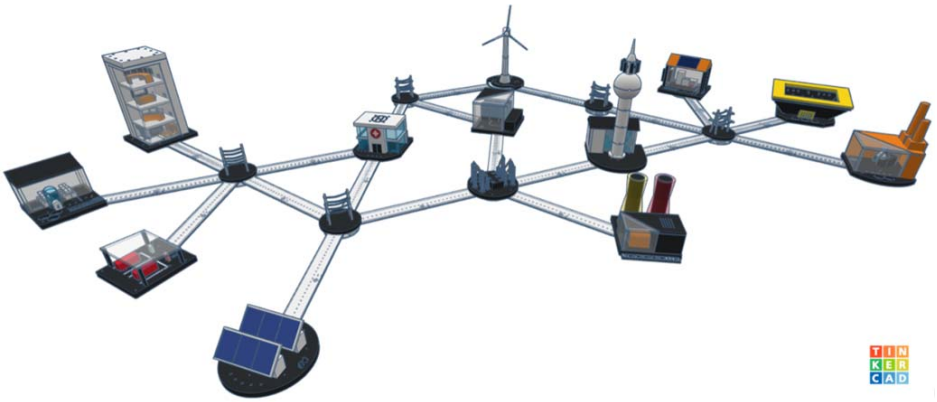


Figure 2: LEGOS Platform developed by RWTH Aachen University

With the help of some simple tasks, the pupils will learn independently about the basic interrelationships in the electrical grid. First, they should set up a simple power supply by connecting the individual nodes and branches with each other. In doing so, they should identify the relationship between voltage, current and resistance and determine the generated and consumed power. After this introduction, they will gain an initial understanding of the stability of the power grid by simulating short circuits at various points and working together to find the best solutions to ensure reliability of supply in the event of a short circuit. The last part deals with the integration of renewable energies as decentralized power plants.

Figure 3: LEGOS Node

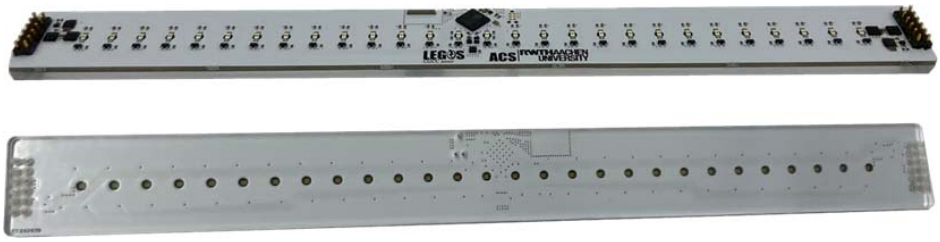


Figure 4: LEGOS Branch

Figure 5: Connected nodes and branches

2.1.2.3. Workshop on Data Platforms for the Energy Infrastructure

Together with the Institute for Electro Mobility of the Bochum University of Applied Sciences, ACS will organize a workshop on open source data platform for the energy infrastructure in the IDEASFORUM e.V. of the City of Herne. The workshop will give a general overview of the challenges of data management. The focus will be the presentation of smart city applications with FIWARE and Message Queue Telemetry Transport (MQTT) and the display of different functions with demonstrators. Part of the workshop will be a general introduction to FIWARE as well as MQTT, practical examples and demonstrations of smart city applications and the presentation of smart energy business models.

Program fact sheet

1. **Name of program:** FIWARE Workshop
2. **Program format:** On campus / On-site
3. **Program language:** English
4. **Length of program:** half day
5. **Student´s estimated effort in working hours:** 2-6h
6. **Industrial challenges addressed 1. - Economic and organizational:** Business model adaptation, Low top management commitment, Goals/ target-tracking
7. **Industrial challenges addressed 2. – Social:** Acceptance of new technologies
8. **Industrial challenges addressed 3. - Technical and regulatory:** Technology integration (compatibility with existing processes/ technologies), Lack of adequate skills from employees
9. **Industrial challenges addressed 4. - Energy system:** Network planning: Digital tools for network planning, Customers: Remote metering
10. **Industrial challenges addressed 5. - Extreme situations:** No
11. **Industrial challenges addressed 6. – Other:** N/A
12. **Skill gap area:** Programming and development competences, Data management and analysis, Big Data
13. **ISCED code of program content:**
    a. **#1:** 0688 Inter-disciplinary programmes and qualifications involving Information and Communication Technologies (ICTs)
    b. **#2:** 0713 Electricity and energy
14. **Starting point of program design:** Both
15. **Funding 1. - Available for free:** Yes

16. **Funding 2. - Types of funding:** N/A
17. **Target groups:** Employees (Mid-career stage), Professionals between jobs
18. **EQF level:** 5/6
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? Yes
    b. Does the program provide credits (ECTS)? No
    c. Is it modularized? Yes
    d. Does it provide any certification per module? No
20. **Certification:** N/A

Business and operational model

1. **Relevance of program:**
    a. **#1:** Increase the citizen involvement in smart city applications
    b. **#2:** Give an introduction in smart city platforms
    c. **#3:** Reach interested people in the area of smart city
2. **Definition of targets:**
    a. Name the skills you target: electricity and energy
    b. Enter their ESCO codes:
    c. Name the occupations you target: Electrical Engineers, Electronics Engineers, Information and Communications Technology Operations and User Support Technicians
    d. Enter their ESCO codes: 2151, 2152, 351
    e. Name the tools and systems that you target: IoT communication protocols
3. **Financial structures:** N/A
4. **Use of resources:**
    a. **#1:** Physical facilities from the City of Herne
    b. **#2:** Demonstrator objects
    c. **#3:** FIWARE Platform
5. **Licenses for digital tools:** No
6. **Marketing and student recruiting procedures:**
    a. **#1:** On the IDEASFORUM e.V. website
    b. **#2:** Distribution among the members of the IDEASFORUM e.V.
7. **Employer feedback:** N/A
8. **Alumni engagement:**
    a. **#1:** Participants can get a member of the IDEASFORUM e.V.
    b. **#2:** Participants can get a member of the FIWARE Foundation

Learning and teaching model

1. **Admission requirements:** No requirements
2. **Training goals:**
    a. Training goal #1: Give an introduction to the FIWARE Platform
    b. Training goal #2: Provide insights into smart city applications with demonstrations
    c. Training goal #3: Provide insights into smart energy business models
3. **Program content - Syllabus elements in ICT/ Digital:**
    a. **#1:** INFORMATION TECHNOLOGY – Networking, communications, and security
    b. **#2:** INFORMATION TECHNOLOGY – New Trends in Information Technology
    c. **#3:** EMBEDDED SYSTEMS – Wireless sensor and Networks
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
    a. **#1:** CONTROL – Digital Control
5. **Program content - Syllabus elements in Energy:**
    a. **#1:** ENERGY MANAGEMENT & GREEN SKILLS – RES (Solar Energy, wind energy)
    b. **#2:** ENERGY MANAGEMENT & GREEN SKILLS – Regulation & new business models
    c. **#3:** ENERGY MANAGEMENT & GREEN SKILLS – Flexible demand and Smart home/buildings
    d. **#4:** ENERGY MANAGEMENT & GREEN SKILLS – Assembly management of RES
6. **Program content - Syllabus elements in transversal skills:**

   a. **#1:** TRANSVERSAL PROFESSIONAL SKILLS – Problem solving
   b. **#2:** TRANSVERSAL PROFESSIONAL SKILLS – Computer Technology
7. **Program content - Re-use of training modules:** Not clear yet
8. **Program content - Intellectual Property Rights:** Material is open to public.
9. **Methodologies:** Magistral lecturing, Worked examples, Interactive lecture, Discussion-based learning
10. **Teaching methods:** Magistral lectures, Practical exercises, Problem solving
11. **Evaluation methods:** Other – Interactive surveys, questionnaire
12. **Internships:** No
13. **Scheduling:** Self-paced

Program Content

The workshop is structured roughly into the following parts:

- Questionnaire at the beginning of the workshop
- Challenges of Data Management (dive into open source and data platforms)
- FIWARE Introduction
- MQTT Introduction
- FIWARE Example Klimaviertel in Herne
- MQTT Example LEGOS
- Smart City Business
- Questionnaire at the end of the workshop

The content and final structure of the workshop is still under development.

2.1.2.4. Summer School on smart electrical power systems

The RWTH International Academy offers a two-week Summer School called “Smart Electrical Power Systems” in July 2023. The content of this program will be the current challenges and new technologies with regard to future electric grids, renewables and Smart Electrical Power Systems. The students will learn about measurement techniques and distributed intelligence for power systems, discuss the future of electrical grids and microgrids, and discover real time simulations of power systems. This will be achieved thorough an understanding of the key challenges of future power systems.

Program fact sheet

1. **Name of program:** Summer school Smart Electrical Power Systems
2. **Program format:** on-campus/ on-site
3. **Program language:** English
4. **Length of program:** 2 weeks: June 25 - July 8, 2023
5. **Student´s estimated effort (total amount of hours):** 60
6. **Industrial challenges addressed 1. – Economic and organizational:** Goals/ target-tracking
7. **Industrial challenges addressed 2. – Social:** Acceptance of new technologies
8. **Industrial challenges addressed 3. – Technical and regulatory:** Technology integration (compatibility with existing processes/technologies)
9. **Industrial challenges addressed 4. – Energy system:** Network planning: Digital tools for network planning
10. **Industrial challenges addressed 5. – Extreme situations:** No
11. **Industrial challenges addressed 6. – Other:** No
12. **Skill gap area:** Programming and development competences, Data management and analysis
13. **ISCED code of program content:**
   a. **#1:** 0713 Electricity and energy
   b. **#2:** 0714 Electronics and automation
   c. **#3:** 0610 Information and Communication Technologies (ICTs) not further defined
14. **Starting point of program design:** both
15. **Funding 1. - Available for free:** No
16. **Funding 2. - Types of funding:** Individual
17. **Target groups:** Students (Pre-career stage)

18. **EQF level:** 6/7
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? - Yes
    b. Does the program provide credits (ECTS)? – Yes, 2 ECTS
    c. Is it modularized? - Yes
    d. Does it provide any certification per module? - No
20. **Certification:** RWTH International Academy Certificate with grade

Business and operational model

1. **Relevance of program:** high-value academic content, excellent hands-on classes and a strong network of industry partners in the field of smart electrical power systems
2. **Definition of targets:**
    a. Name the skills you target: run simulations, electricity and energy, electricity market
    b. Enter their ESCO codes:
    c. Name the occupations you target: Electrotechnology engineers, Software and applications developers and analysts
    d. Enter their ESCO codes: 215, 251
    e. Name the tools and systems that you target: N/A
3. **Financial structures:**
    a. **#1:** Students pay a Course fee of 1,990€ for the summer school
4. **Use of resources:**
    a. **#1:** Physical facilities at RWTH Aachen University
    b. **#2:** Real time simulation equipment
    c. **#3:** Lectures from the institutes ACS, Power Generation and Storage Systems (PGS) and High Voltage Equipment and Grids, Digitalisation and Power Economics (IAEW)
    d. **#4:** Online Moodle course room with educational materials and additional information
5. **Licenses for digital tools:** No
6. **Marketing and student recruiting procedures:**
    a. **#1:** Dissemination on the RWTH International Academy website
    b. **#2:** Dissemination through international partner universities
7. **Employer feedback:** N/A
8. **Alumni engagement:**
    a. **#1:** Possibility to sign up to Leonardo lecture newsletter.
    b. **#2:** Possibility to follow the Leonardo Blog.

Learning and teaching model

1. **Admission requirements:** High school diploma, Bachelor degree
2. **Training goals:**
    a. Training goal #1: Understand the role of measurements and monitoring
    b. Training goal #2: Learn new measurement requirements and technologies
    c. Training goal #3: See how renewables change key concepts of power systems
    d. Training goal #4: Master the theoretical implementation of a microgrid
    e. Training goal #5: Make use of real time simulation in laboratory exercises
3. **Program content - Syllabus elements in ICT/ Digital:**
    a. **#1:** MODELLING, SIMULATION & OPTIMISATION – Simulation tools (Matlab. Labview, R)
    b. **#2:** MODELLING, SIMULATION & OPTIMISATION – Modelling, simulation & optimisation
    c. **#3:** PROGRAMMING LANGUAGES – Computer Technology
    d. **#4:** INFORMATION TECHNOLOGY – New Trends in Information Technology
    e. **#5:** CONTROL – Digital Control
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
    a. **#1:** ELECTRICAL ENGINEERING – Electrical engineering
    b. **#2:** CONTROL – Digital Control
    c. **#3:** MODELLING, SIMULATION & OPTIMISATION – Modelling, simulation & optimisation
5. **Program content - Syllabus elements in Energy:**

   a. **#1:** MODELLING, SIMULATION & OPTIMISATION – Simulation tools (Matlab. Labview, R)
   b. **#2:** ENGINEERING PROJECTS & REPORTS – Engineering projects, management & control
   c. **#3:** POWER ELECTRONICS – Applications: electric drives & controllers
   d. **#4:** ELECTRICAL ENGINEERING – Electrical instrumentation
   e. **#5:** ELECTRICAL ENGINEERING – Electrical engineering
   f. **#6:** ENERGY MANAGEMENT & GREEN SKILLS – Flexible demand and Smart home/building
   g. **#7:** ELECTRICAL POWER SYSTEMS – Grid Development in the area of Smart Grids
   h. **#8:** ELECTRICAL POWER SYSTEMS – Planning & Operation of future distribution networks
6. **Program content - Syllabus elements in transversal skills:**
   a. **#1:** FOREIGN LANGUAGES – English (mandatory)
   b. **#2:** TRANSVERSAL PROFESSIONAL SKILLS – Verbal & written communication
   c. **#3:** HUMANITIES & ETHICS – Critical thinking
   d. **#4:** TRANSVERSAL PROFESSIONAL SKILLS – Computer Technology
7. **Program content - Re-use of training modules:** Yes, in other similar lectures and in next year's summer school
8. **Program content - Intellectual Property Rights:** All contents are protected by copyright. They may only be used within the limited circle of participants of the Moodle learning room and for private purposes. Sharing the content beyond the limited group of participants in the Moodle learning room thus constitutes publication subject to permission.
9. **Methodologies:** Project-based learning, Magistral lecturing, Discussion-based learning, Interactive lecture, Worked examples
10. **Teaching methods:** Magistral lectures, Practical lab sessions, Problem solving
11. **Evaluation methods:** Written Exam/Case Study (t.b.d)
12. **Internships:** No
13. **Scheduling:** Full-time

Program Content

RWTH Aachen University's E.ON Energy Research Center is responsible for the academic content. Two divisions of E.ON ERC conduct the lectures: Automation of Complex Power Systems, and also Power Generation and Storage Systems. Plus, the Institute for High Voltage Equipment and Grids, Digitalisation and Power Economics supports the teaching. At the end of the summer school students receive a RWTH certificate from international academy, which is possible to integrate in Bachelor's or Master's programs with individual validation process of students' home universities.

The summer school consist of the following four modules:

1. **Measurement Techniques and Distributed Intelligence for Power Systems:**
   The course presents the role of measurements and monitoring in power systems, and it introduces the new measurement requirements and technologies of modern power systems.
   The fundamentals of measurements are briefly recalled, with particular attention to measurement uncertainty. Sensors and instruments are reviewed, with emphasis on Phasor Measurement Units as key component in synchronized measurements. The state estimation is introduced as most significant example of monitoring function. Notes on the digitalisation of the measurement and monitoring processes are presented.
2. **Electrical Grids Today and Tomorrow:**
   The module gives an overview of what is changing in power systems, how renewables are changing some of the key concepts that have been applied for many years and outlines the perspective about the system of the future.
3. **Real Time Simulation and Power System Dynamics:**
   This module will be conducted as laboratory exercise about real time simulation and power system dynamics. Students will learn how to use a modern research tool: Real time simulation. By using this tool, they will directly experience some key concepts of power system dynamics in a computer simulation.
4. **Microgrids & Real Time Simulation and Key Challenges of Future Power Systems:**
   The Microgrids module introduces the topic microgrids: Definition, structure and implementation of a microgrid. It also deals with the role of microgrids in future energy systems.The Real Time Simulation and Key Challenges of Future Power Systems module will be conducted as laboratory exercise in which

students will have the chance to use real time simulation again to understand some of the key challenges of future power systems

2.1.2.5. Leonardo lecture on energy transition

The Leonardo lecture series “Energy Transition – Potential Tension between Economy, Politics and Science” at RWTH is an interdisciplinary teaching series of lectures open to all students. Lecturers from different scientific backgrounds and industry collectively offer this course to a broad audience by highlighting different parts of the energy transition. Depending on the study regulations and performance, 2 ECTS credits can be acquired through participation and a protocol with a critical analysis. In addition, a Certificate of Participation (0 ECTS, not graded) is possible. The main part of this pilot activity is the lecture “Digital Energy Revolution” by Prof. Monti from the Institute for Automation of Complex Power Systems highlighting the topic digitalisation of the energy system and the lecture “Urban Electrical Energy Systems” by Prof. Ponci from the Teaching and Research Area Monitoring and Distributed Control for Power Systems.

Program fact sheet

1. **Name of program:** Energiewende (engl. Energy Transition)
2. **Program format:** On campus / On-site
3. **Program language:** german/english
4. **Length of program:** 6 months
5. **Student´s estimated effort in working hours:** 60
6. **Industrial challenges addressed 1. – Economic and organizational:** Goals/ target-tracking
7. **Industrial challenges addressed 2. – Social:** Acceptance of new technologies
8. **Industrial challenges addressed 3. – Technical and regulatory:** Data management, Technology integration (compatibility with existing processes/ technologies)
9. **Industrial challenges addressed 4. - Energy system:** Customers: Dedicated information about their energy profile, Digital tools for network planning
10. **Industrial challenges addressed 5. - Extreme situations:** No
11. **Industrial challenges addressed 6. – Other:** N/A
12. **Skill gap area:** Programming and development competences, Data management and analysis
13. **ISCED code of program content:**
    a. **#1:** 0520 Environment not further defined
    b. **#2:** 0713 Electricity and energy
    c. **#3:** 0488 Inter-disciplinary programmes and qualifications involving business, administration and law
14. **Starting point of program design:** Energy program with an ICT add-on
15. **Funding 1. - Available for free:** Yes
16. **Funding 2. - Types of funding:** N/A
17. **Target groups:** Students (Pre-career stage)
18. **EQF level:** 6-7
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? No
    b. Does the program provide credits (ECTS)? Yes
    c. Is it modularized? No
    d. Does it provide any certification per module? No
20. **Certification:** Certificate of Accomplishment

Business and operational model

1. **Relevance of program:**
    a. **#1:** Convey the challenges, possibilities and concepts related to the digitalisation and transformation of the energy sector.
    b. **#2:** Highlight current discourses and challenges in the context of energy (policy).
    c. **#3:** Reaching a wide range of interdisciplinary students and creating a discussion forum about the energy transition.

d. **#4:** Connect students, research and industry stakeholders with each other to discuss the energy transition.
e. **#5:** Promoting the empowerment of students to use their subject-specific knowledge in a broader context to tackle global and societal challenges and thus to solve problems with responsibility.

2. **Definition of targets:**
   a. Name the skills you target: electricity and energy
   b. Enter their ESCO codes: N/A
   c. Name the occupations you target: N/A
   d. Enter their ESCO codes:N/A
   e. Name the tools and systems that you target: understanding the challenges and opportunities of the energy transition
3. **Financial structures:**
   a. **#1:** Payment of RWTH external lectures from a dedicated RWTH Leonardo fund
4. **Use of resources:**
   a. **#1:** Physical facility on the campus of RWTH
   b. **#2:** Online Moodle course room with educational materials and additional information
5. **Licenses for digital tools:** No
6. **Marketing and student recruiting procedures:**
   a. **#1:** Distributing the course program among all students of the RWTH in the beginning of the semester by Mail from Human Technology Center
   b. **#2:** Leonardo lecture website with information
7. **Employer feedback:** N/A
8. **Alumni engagement:**
   a. **#1:** Students of the summer school will become part of the alumni network of the RWTH International Academy with exclusive updates and a alumni newsletter.
   b. **#2:** Possibility to continue to participate in career events and benefit from the job postings.
   c. **#3:** Students have the possibility to stay connected with other graduates at Alumni events and expand their professional network.
   d. **#4:** Former students of the summer school can become a business partner in the job portal and search the talent database or the Career Center events for promising candidates.

Learning and teaching model

1. **Admission requirements:** High school diploma
2. **Training goals:**
   a. **Training goal #1:** The students know the technical possibilities as well as the hurdles on the way to a CO2-neutral power generation and future-oriented power distribution.
   b. **Training goal #2:** The students understand the different requirements for distribution and transmission grids and can thus comprehend the debate on grid expansion or grid restructuring.
   c. **Training goal #3:** The students learn to evaluate the tensions arising from the complete realignment of the energy sector and the social and economic requirements.
   d. **Training goal #4:** The students are able to look at issues regarding the energy transition from different angles.
   e. **Training goal #5:** The students are able to carry out reflections on the future energy supply.
3. **Program content - Syllabus elements in ICT/ Digital:**
   a. **#1:** INFORMATION TECHNOLOGY – New Trends in Information Technology
   b. **#2:** CONTROL – Digital control
   c. **#3:** CONTROL – Remote Control and Automation
   d. **#4:** ENGINEERING PROJECTS & REPORTS – Papers, reports
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
   a. **#1:** ENGINEERING PROJECTS & REPORTS – Papers, reports
   b. **#2:** HEAT & COOLING ENGINEERING – Heat & Cooling installations
   c. **#3:** CONTROL – Control systems
   d. **#4:** ELECTRICAL ENGINEERING – Power Plant (conventional and RES) Operation and Maintenance
   e. **#5:** MECHANICAL ENGINEERING – Power Plant (conventional and RES) Operation and Maintenance

5. **Program content - Syllabus elements in Energy:**
    a. **#1:** ENERGY MANAGEMENT & GREEN SKILLS – Energy Transition
    b. **#2:** ENERGY MANAGEMENT & GREEN SKILLS – Flexible demand and Smart home/building
    c. **#3:** ELECTRICAL POWER SYSTEMS – Grid Development in the area of Smart Grids
    d. **#4:** ELECTRICAL POWER SYSTEMS – Optimal Power Flow, systems operation & control
    e. **#5:** ELECTRICAL POWER SYSTEMS – RES (Solar Energy, wind energy)
    f. **#6:** ELECTRICAL ENGINEERING – Power Plant (conventional and RES) Operation and Maintenance
    g. **#7:** MECHANICAL ENGINEERING – Power Plant (conventional and RES) Operation and Maintenance
6. **Program content - Syllabus elements in transversal skills:**
    a. **#1:** FOREIGN LANGUAGES – English (mandatory)
    b. **#2:** TRANSVERSAL PROFESSIONAL SKILLS – Verbal & written communication
    c. **#3:** HUMANITIES & ETHICS – Critical thinking
    d. **#4:** MANAGEMENT & BUSINESS - Economy of Energy, Markets and Regulation
7. **Program content - Re-use of training modules:** Yes, other similar lecture (t.b.d.)
8. **Program content - Intellectual Property Rights:** All contents are protected by copyright. They may only be used within the limited circle of participants of the Moodle learning room and for private purposes. Sharing the content beyond the limited group of participants in the Moodle learning room thus constitutes publication subject to permission.
9. **Methodologies:** Magistral lecturing, Interactive lecture, Discussion-based learning
10. **Teaching methods:** Magistral lectures, Personal study
11. **Evaluation methods:** Other - Report
12. **Internships:** No
13. **Scheduling:** Full-Time

Program Content

In the context of the lecture series "Energy Transition – Potential Tension between Economy, Politics and Science", current discourses and challenges in the context of energy (policy) are highlighted and discussed. Different forms of energy as well as their production and supply mechanisms are also considered. The political and economic interests are considered and compared with the technical feasibility. Different fields of action and approaches to solutions are discussed from an interdisciplinary point of view. An overview of actors in the energy industry, regional energy production in Aachen and current research issues will be provided. The final discussion is prepared by questions of the students in the course of the module. For this, students collect points in the first two months, which will be discussed in the last event.

The general program is organized by RWTH Human Technology Center, whereas the content outline is organized by Prof. De Doncker from E.ON Energy Research Center, RWTH Aachen. In the following is the list of lectures and lecturers:

Table 3: List of lectures in the Leonardo lecture series “Energy Transition – Potential Tension between Economy, Politics and Science”

1	Introduction and Information	Prof. Rik De Doncker	E.ON Energy Research Center, RWTH Aachen
2	Flexible electrical Grids for the Energy Transition – *English session*	Prof. Rik De Doncker	E.ON Energy Research Center, RWTH Aachen
3	Charting the Energy Future – an introduction to trends, scenario thinking and innovation strategies – *English session*	Bert Stuij, Vice President Innovation	Energy Delta Institute (NL)
4	Hydrogen Economy – considerations of efficiency, application areas and challenges	Prof. Dirk Uwe Sauer	Chair for Electrochemical Energy Conversion and

			Storage Systems, RWTH Aachen
5	Energy-efficient building	Prof. Dirk Müller	Institute for Energy Efficient Buildings and Indoor Climate, RWTH Aachen
6	Selected Economic Aspects and Issues of a Sustainable Energy Transition – *English session*	Prof. Reinhard Madlener	Institute of Future Energy Consumer Needs and Behavior, RWTH Aachen
7	**Digitalisation of the energy system – *English Session***	**Prof. Antonello Monti**	**Institute for Automation of Complex Power Systems, RWTH Aachen**
8	Circular Economy 4.0: Digitization as a fire accelerator or opportunity driver for more climate protection and resource efficiency in industrial transformation?	Dr. Stephan Ramesohl	Co-Head of Research Unit Digital Transformation Division Circular Economy, Wuppertal Institute
9	**Urban Electrical Energy Systems – *English Session***	**Prof. Ferdinanda Ponci**	**Teaching and Research Area Monitoring and Distributed Control for Power Systems, RWTH Aachen**
10	How secure is our energy supply?	Prof. Aaron Praktiknjo	Energy Resource and Innovation Economics, RWTH Aachen
11	Energy Transition: Goals, ways and challenges	Dr. Frank-Detlef Drake	E.ON SE

The focus in this piloting activity is more on the lectures “Digital Energy Revolution” and “Urban Electrical Energy Systems”. Content of the lecture “Digital Energy Revolution” is:

- Digitalisation is completely transforming the energy sector
- New options and possibilities are open at every level
- Digitalisation means also new concepts for operation that completely transform the way the grid is operated
- Open standards are key enablers for this process

Subject matter of the lecture “Urban Electrical Energy Systems” is:

- Impact and complexity of urban energy systems
- Energy communities – Types, objectives, relations and characteristics
- Performance and characteristics of Smart grids
- Different forms of local energy systems

2.1.2.6. ACS lecture on automation of complex systems

The Automation of Complex Power Systems Institute at the E.ON ERC of RWTH University offers the lecture ‘‘Automation of Complex Power Systems’’. It provides an introductory course on current research topics in modern power systems. Through this course, students will gain a basic understanding of the technologies used to monitor, control and communicate complex power systems.

Program fact sheet

1. **Name of program:** Automation of Complex Power Systems (ACS) lecture
2. **Program format:** On campus / On-site and Online
3. **Program language:** English
4. **Length of program:** 6 months

5. **Student´s estimated effort in working hours:** 120 h
6. **Industrial challenges addressed 1. - Economic and organizational:** N/A
7. **Industrial challenges addressed 2. – Social:** Acceptance of new technologies
8. **Industrial challenges addressed 3. - Technical and regulatory:** Technology integration
9. **Industrial challenges addressed 4. - Energy system:**
    a. #1: Network operation: Automation and fault clearance
    b. #2: Network operation: Load Profiles
10. **Industrial challenges addressed 5. - Extreme situations:** N/A
11. **Industrial challenges addressed 6. – Other:** N/A
12. **Skill gap area:** Programming and development competences
13. **ISCED code of program content:** 0713 and 0714
14. **Starting point of program design:** Energy program with an ICT add-on
15. **Funding 1. - Available for free:** Yes
16. **Funding 2. - Types of funding:** N/A
17. **Target groups:** Students (Pre-career stage)
18. **EQF level:** 7
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? - No
    b. Does the program provide credits (ECTS)? – Yes
    c. Can you study parts of the program? - No
    d. Does it provide any certification per module? - No
20. **Certification:** N/A

Business and operational model

1. **Relevance of program:**
    a. **#1:** Provides an overview of the necessary competence for designing the energy system of the future
    b. **#2:** Introduction into a modern power system
2. **Definition of targets:**
    a. Name the skills you target: K-knowledge - engineering, manufacturing and construction - engineering and engineering trades - electronic and automation / electricity and energy
    b. Enter their ESCO codes:
    c. Name the occupations you target: Electrical engineers - electrical engineer
    d. Enter their ESCO codes: 2151.1
    e. Name the tools and systems that you target:
3. **Financial structures:** University Course - financed by the state North Rhine-Westphalia
4. **Use of resources:**
    a. **#1:** Classroom
    b. **#2:** Matlab / Simulink
    c. **#3:** Moodle
    d. **#4:** Jupyter
5. **Licenses for digital tools: Yes**
6. **Marketing and student recruiting procedures:**
    a. **#1:** ACS Webpage
    b. **#2:** Student event at the institute
    c. **#3:** Lecture overview
7. **Employer feedback:** N/A
8. **Alumni engagement:**
    a. **#1:** Engagement as working student possible

Learning and teaching model

1. **Admission requirements:**
2. **Training goals:**
    a. Training goal #1: Basics of automation of power systems as it is today

   b. Training goal #2: Tools to realize the transformation to a modern grid
   c. Training goal #3: Control techniques required in a modern grid
   d. Training goal #4: Interdisciplinary approach to the automation of power systems
3. **Program content - Syllabus elements in ICT/ Digital:**
   a. **#1:** PROGRAMMING LANGUAGES – C, C++, Matlab, Phthon
   b. **#2:** COMMHNICATIONS; NETWORKS & BUSES – Remote control Systems, SCADA Systems
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
   a. **#1:** CONTROL – Distributed Control
   b. **#2:** CONTROL – Control systems
   c. **#3:** CONTROL – Remote Control and Automation
   d. **#4:** MODELLING, SIMULATION & OPTIMISATION – Simulation tools (Matlab, Labview, R)
   e. **#5:** MODELLING, SIMULATION & OPTIMISATION – Modelling, simulation & optimization
5. **Program content - Syllabus elements in Energy:**
   a. **#1:** ENERGY MANAGEMENT & GREEN SKILLS – Energy Transition
   b. **#2:** ENERGY MANAGEMENT & GREEN SKILLS – RES (Solar Energy, wind energy)
   c. **#3:** ELECTRICAL POWER SYSTEMS – Grid Development in the area of Smart Grids
   d. **#4:** ELECTRICAL POWER SYSTEMS – Planning & Operation of future distribution networks
   e. **#5:** ELECTRICAL POWER SYSTEMS – RES (Solar Energy, wind energy)
   f. **#6:** ELECTRICAL ENGINEERING – Electrical instrumentation
   g. **#7:** ELECTRICAL ENGINEERING – Electrical engineering
   h. **#8:** POWER ELECTRONICS – Power electronics
   i. **#9:** POWER ELECTRONICS – Applications: electric drives & controllers
   j. **#10:** MODELLING, SIMULATION & OPTIMISATION – Simulation tools (Matlab, LAbview, R)
6. **Program content - Syllabus elements in transversal skills:**
   a. **#1:** HUMANITIES & ETHICS – Critical thinking
   b. **#2:** TRANSVERSAL PROFESSIONAL SKILLS – Teamwork
   c. **#3:** TRANSVERSAL PROFESSIONAL SKILLS – Problem solving
7. **Program content - Re-use of training modules:** Yes - Lecture Future Energy Systems II
8. **Program content - Intellectual Property Rights:** All contents are protected by copyright. They may only be used within the limited circle of participants of the Moodle learning room and for private purposes. Sharing the content beyond the limited group of participants in the Moodle learning room thus constitutes publication subject to permission.
9. **Methodologies:** Practical learning, problem-based learning, Project-based learning, Worked examples, Interactive lecture, Discussion-based learning
10. **Teaching methods:** Project, Personal study, Problem solving, Search for and select bibliographical material, data or statistics
11. **Evaluation methods:** Written examination and Project
12. **Internships:** No
13. **Scheduling:** Part-Time

Program Content

The course Automation of Complex Power System (ACS) teaches skills for designing a modern energy system. This includes the areas of control and automation of the energy system. It focuses in particular on frequency and voltage control as well as potential power quality problems and their solutions. Since modern energy systems are based on renewable energies, initial knowledge of renewable energy sources and alternative grid concepts, such as micro grids, is taught. This includes the power electronic interface as well as control structures for distributed energy sources and for the converters themselves. A large number of renewable energy sources work either with direct current (PV) or use a DC link (wind). Therefore, the concept of DC distribution grids is presented and possible control strategies and protection concepts are elaborated. The increasing share of volatile distributed energy sources requires not only a suitable measurement infrastructure for monitoring the system and appropriate communication standards, but also load management concepts for demand side management. The use of interactive Jupyter notebooks allows students hands-on experience in programming techniques and simulations.

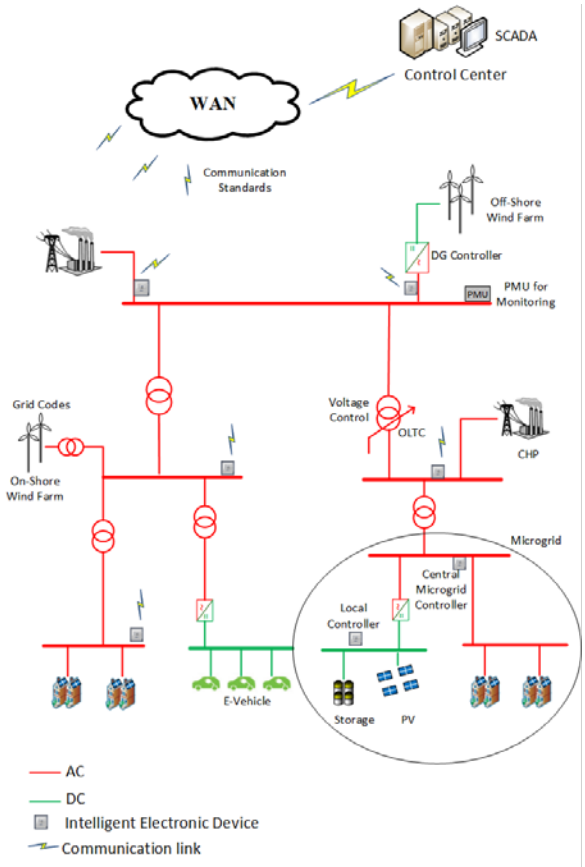


Figure 6: Content of the ACS lecture

2.1.2.7. Science Night at RWTH

The Science Night is a yearly event hosted by the RWTH and its Institutes with numerous lectures, experiment stations and exhibit booths to illustrate scientific topics to everyone in a tangible way. Also ACS is part of this with a presentation on digital energy and a demonstration model of an electrical grid (see LEGOS).

Program fact sheet

1. **Name of program:** Wissenschaftsnacht (Eng. Science Night)
2. **Program format:** On campus / On-site
3. **Program language:** German
4. **Length of program:** 1 day
5. **Student´s estimated effort in working hours:** 5h
6. **Industrial challenges addressed 1. - Economic and organizational:** Goals/ target-tracking
7. **Industrial challenges addressed 2. – Social:** Acceptance of new technologies
8. **Industrial challenges addressed 3. - Technical and regulatory:** Technology integration (compatibility with existing processes/ technologies)
9. **Industrial challenges addressed 4. - Energy system:** Network planning: Digital tools for network planning
10. **Industrial challenges addressed 5. - Extreme situations:** No
11. **Industrial challenges addressed 6. – Other:** N/A
12. **Skill gap area:** N/A
13. **ISCED code of program content:** 0099 or 0031 and 0713
14. **Starting point of program design:** Energy program with an ICT add-on
15. **Funding 1. - Available for free:** Yes
16. **Funding 2. - Types of funding:** N/A

17. **Target groups:** Students (Pre-career stage), Employees (Mid-career stage), Professionals between jobs
18. **EQF level:** 1-8
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? Yes
    b. Does the program provide credits (ECTS)? No
    c. Is it modularized? No
    d. Does it provide any certification per module? No
20. **Certification:** N/A

Business and operational model

1. **Relevance of program:**
    a. **#1:** Public relations work
    b. **#2:** visibility of scientific issues
    c. **#3:** raising public awareness of energy technology and digital issues
    d. **#4:** pointing out solutions for a sustainable and secure energy supply
2. **Definition of targets:**
    a. Name the skills you target: electricity and energy
    b. Enter their ESCO codes: N/A
    c. Name the occupations you target: N/A
    d. Enter their ESCO codes: N/A
    e. Name the tools and systems that you target: N/A
3. **Financial structures:** N/A
4. **Use of resources:**
    a. **#1:** Presentation
    b. **#2:** Energy grid demonstrator (LEGOS)
5. **Licenses for digital tools:** No
6. **Marketing and student recruiting procedures:**
    a. **#1:** RWTH Aachen webpage
    b. **#2:** Information flyers and posters in the city of Aachen
    c. **#3:** Advertisements in local newspapers
7. **Employer feedback:**
    a. **#1:** Questionnaire on the program presented
    b. **#2:** Evaluation of the questionnaires
8. **Alumni engagement:** N/A

Learning and teaching model

1. **Admission requirements:** No requirements
2. **Training goals:**
    a. Training goal #1: Awareness-raising on the topic of the energy transition and renewable energies
    b. Training goal #2: Introduction to digitalisation of the energy grid
    c. Training goal #3: Introduction to the operation and issues of the energy grid
3. **Program content - Syllabus elements in ICT/ Digital: /**
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
    a. **#1:** CONTROL – Control system
    b. **#2:** CONTROL – Distributed Control
5. **Program content - Syllabus elements in Energy:**
    a. **#1:** ELECTRICAL ENGINEERING - configuration of RES Installations
    b. **#2:** ELECTRICAL ENGINEERING - Electrical Substations
    c. **#3:** ELECTRICAL ENGINEERING - Electrical design
    d. **#4:** ELECTRICAL ENGINEERING - Electrical engineering
    e. **#5:** ELECTRICAL POWER SYSTEM - RES (Solar Energy, wind energy)
    f. **#6:** ELECTRICAL POWER SYSTEM - power plants, lines and substations
    g. **#7:** ENERGY MANAGEMENT & GREEN SKILLS - Energy transition
6. **Program content - Syllabus elements in transversal skills:**

a. **#1:** Humanities & Ethics - Critical thinking
b. **#2:** Transversal Professional Skills - Problem Solving

7. **Re-use of training modules:** Yes – Training modules used from the Gymnasium Workshop
8. **Intellectual Property Rights:** No
9. **Methodologies:** Magistral lecturing, Interactive lecture, Discussion-based learning, Worked examples
10. **Teaching methods:** Magistral lectures, Practical lab sessions
11. **Evaluation methods:** No evaluation necessary
12. **Internships:** No
13. **Scheduling:** Evening attendance

Program Content

The Science Night first includes an introduction to the topic of electricity grids by means of a presentation. The presentation entitled "Active customers for active grids" shows the changes in the distribution grid due to the increasing number of distributed generation plants. The focus will also be on grid stability and the associated role of customers. The audience will learn about the increasingly active role of customers in the electricity market due to decentralized small power plants and solutions such as smart meters. The digitalisation of the energy system serves as a key function for active customers and the concept of the energy community promoted by the European Commission. To this end, the presentation will introduce reference solutions such as the SOGNO software platform developed by RWTH Aachen University, which has received an award. Finally, some examples show first solutions for the active integration of customers through digitalisation measures.

In a second part, the participants will have the chance to visually see the effects of small changes in the power grid using the Lite Emulator of Grid Operations (LEGOS) developed by RWTH. LEGOS is a multi-layered learning platform for demonstrating use cases of smart energy services. It consists of nodes that allow the connection of up to 6 branches and one unit (generator, consumer, storage, ...). Each branch is an active component that enables measurement and control of the energy flow between two units. The LED strips on the branches allow visualization of the magnitude and direction of the current flow through their activation patterns. Each unit can be controlled remotely through haptic interaction or as an IoT device. The activity “Gymnasium Workshop” use the same LEGOS demonstrator.

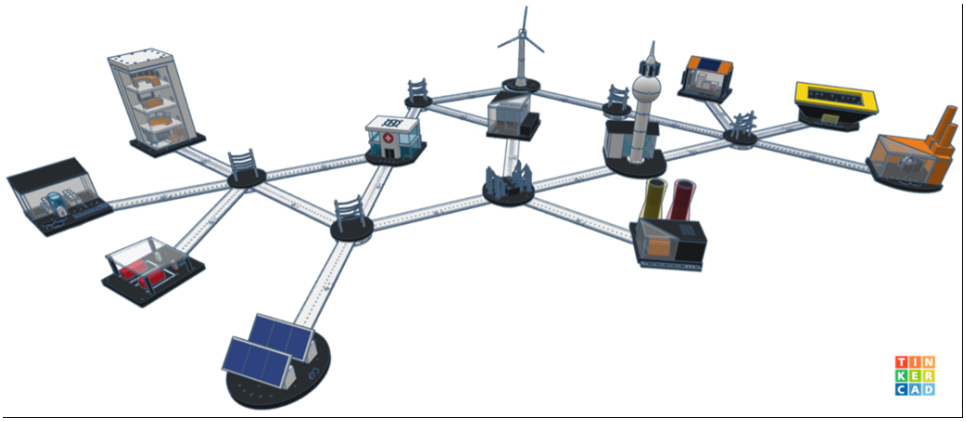


Figure 7: LEGOS Platform developed by RWTH Aachen University

2.1.2.8. Girl’s Day at ACS

Girls' Day is a nationwide project for career and study orientation for girls. On this annual day of action, female students learn about professions or fields of study in which the proportion of women is less than 40 percent. Girls from grade 5 are addressed.

The main component of this pilot activity is a seminar for lower secondary female students at the Institute for Automation of Complex Energy Systems. In the seminar, the female students explore the generation of electricity based on renewable energies (mainly wind turbines) using a model.

Program fact sheet

1. **Name of program:** Girls Day
2. **Program format:** On campus / On-site
3. **Program language:** German
4. **Length of program:** 1 day
5. **Student´s estimated effort in working hours:** 6h8
6. **Industrial challenges addressed 1. – Economic and organizational:** N/A
7. **Industrial challenges addressed 2. – Social:** Acceptance of new technologies
8. **Industrial challenges addressed 3. – Technical and regulatory:** Technology integration
9. **Industrial challenges addressed 4. – Energy system:** N/A
10. **Industrial challenges addressed 5. – Extreme situations:** No
11. **Industrial challenges addressed 6. – Other:** Promoting young talent / labor shortage
12. **Skill gap area:** Programming and development competences
13. **ISCED code of program content:** 0713 Electricity and energy
14. **Starting point of program design:** Energy program with an ICT add-on
15. **Funding 1. - Available for free:** yes
16. **Funding 2. - Types of funding:** N/A
17. **Target groups:** Students (lower secondary education)
18. **EQF level:** 1-3
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? No
    b. Does the program provide credits (ECTS)? No
    c. Is it modularized? No
    d. Does it provide any certification per module? No
20. **Certification:** N/A

Business and operational model

1. **Relevance of program:**
    a. #1: Vocational orientation project for female pupils
    b. #2: Promoting young talent in engineering and IT professions
2. **Definition of targets:**
    a. Name the skills you target: energy and electricity
    b. Enter their ESCO codes: N/A
    c. Name the occupations you target: N/A
    d. Enter their ESCO codes: N/A
    e. Name the tools and systems that you target: N/A
3. **Financial structures:** N/A
4. **Use of resources:**
    a. **#1:** Wind turbine model to study the generation of electricity
5. **Licences for digital tools:** No
6. **Marketing and student recruiting procedures:**
    a. **#1:** nationwide Girls' Day website
    b. **#2:** Posters in schools
    c. **#3:** RWTH website
7. **Employer feedback:** N/A
8. **Alumni engagement:** N/A

Learning and teaching model

14. **Admission requirements:** No requirements
15. **Training goals:**
    a. Training goal #1: Generate interest in STEM subjects
    b. Training goal #2: Raising interest and awareness around the young generation, on modern power systems engineering and energy transition topics

   c. Training goal #3: Impart knowledge about wind power and renewable energies and arouse enthusiasm for the topics
   d. Training goal #4: Promoting young talent in engineering and IT professions
16. **Program content - Syllabus elements in ICT/ Digital: /**
17. **Program content - Syllabus elements in another STEM than ICT/Digital:**
    a. **#1:** BASIC ELECTRICITY – Electricity theory, Current, voltage & components
    b. **#2:** ELECTRICAL ENGINEERING – Power Plant (conventional and RES) Operation and Maintenance
18. **Program content - Syllabus elements in Energy:**
    a. #1: ENERGY MANAGEMENT & GREEN SKILLS – Energy Transition
    b. **#2:** ENERGY MANAGEMENT & GREEN SKILLS – RES (Solar Energy, wind energy)
    c. **#3:** ENERGY MANAGEMENT & GREEN SKILLS – Regulation & new Business Models
    d. **#4:** Electrical Engineering - configuration of RES Installations
    e. **#5:** Electrical Engineering - Electrical design
    f. **#6:** Electrical Engineering - Electrical engineering
19. **Program content - Syllabus elements in transversal skills:**
    a. **#1:** TRANSVERSAL PROFESSIONAL SKILLS –Teamwork
    b. **#2:** TRANSVERSAL PROFESSIONAL SKILLS – Problem solving
    c. **#3:** HUMANITIES & ETHICS – Critical thinking
20. **Re-use of training modules:** Yes – Reuse of the landscape model for the Girl's Day at ACS
21. **Intellectual Property Rights:** No
22. **Methodologies:** Practical learning, Problem-based learning, Worked examples, Interactive lecture
23. **Teaching methods:** Practical exercises, Problem solving
24. **Evaluation methods:** No evaluation necessary
25. **Internships:** No
26. **Scheduling:** Half-day event

Program Content

The most important teaching object is based on the wind park and energy grid model, which was already used in the "Archimedischer Sandkasten" activity. This model was extended to form a modular wind turbine model for the Girl's Day. It now consists of individual modules that can be connected to each other in any way. As before, small wind turbines can be connected to specific connection points within the individual modules. The individual modules represent different areas in the energy system; in addition to the previous onshore wind turbines, the model has been expanded to include a module representing an offshore wind park. In addition, LED lights representing consumers are grouped into different consumer groups. Also part of the landscape are the already existing solid capacitors as energy storage and newly integrated PV systems.

Fans generate wind and direct it to the wind turbines. The PV systems react to light sources. The generated wind and PV power switches on the LED lights. Depending on the number of wind turbines and the rotation speed as well as the emulated solar irradiation, the LED lights might fluctuate. This provides an understanding of the principle load equal to generation. To stabilize the fluctuations, the energy storage units can be activated, to explain the principle of energy storage. In addition, the voltage can be observed in a voltmeter.

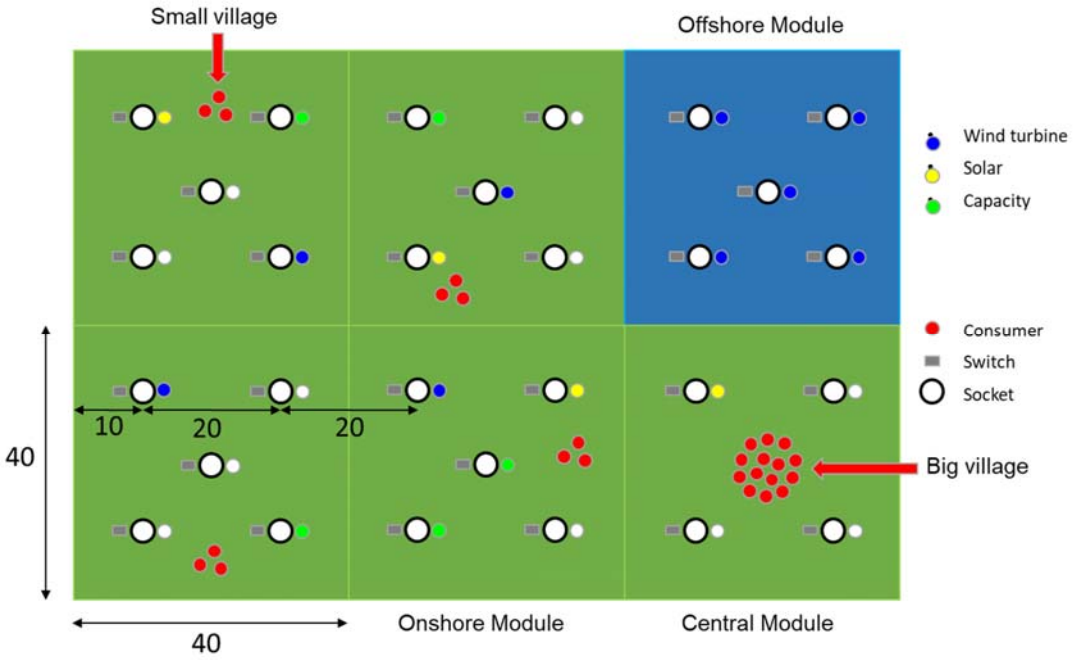
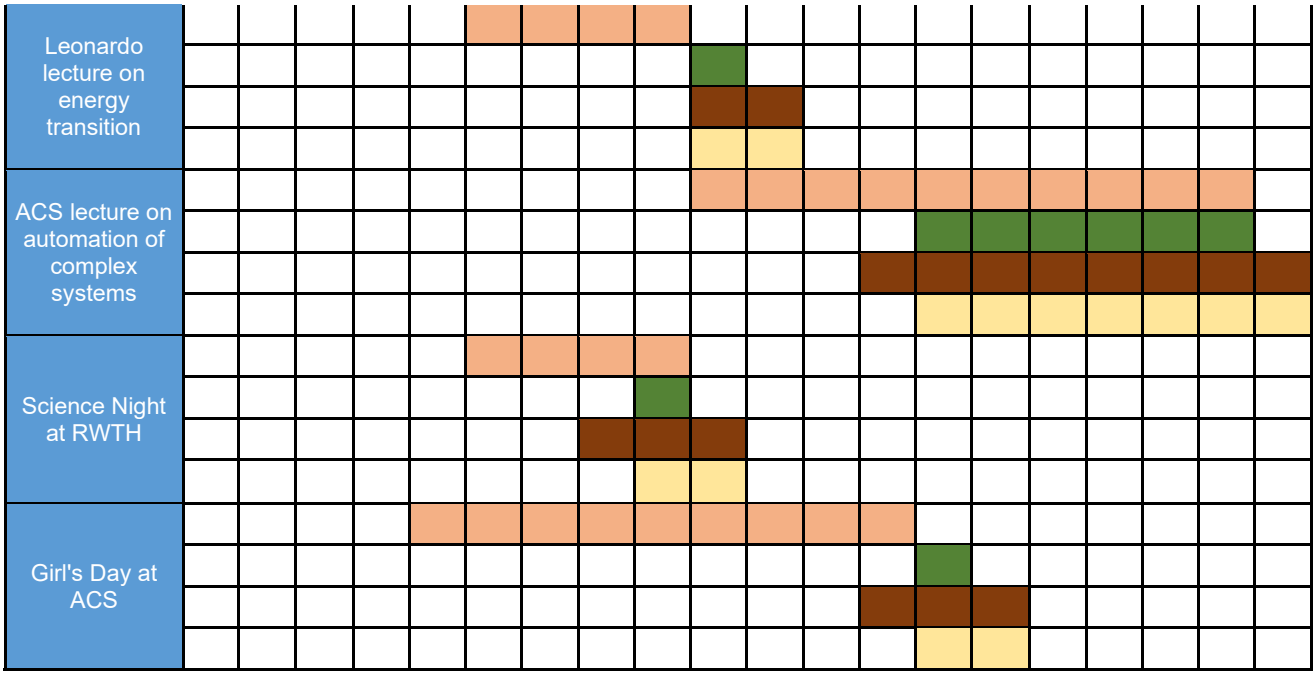


Figure 8: Modular based wind-park model

2.1.3. Timeline of activities

Table 4: Timeline of activities provided by RWTH Aachen University

Activity	Month																			
	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23
Archimedischer Sandkasten with the city of Aachen																				
Gymnasium workshop																				
Workshop on Data Platforms for the Energy Infrastructure																				
Summer School on smart electrical power systems																				



	design
	analysis
	implementation
	assessment

3. Status of other field tests

3.1. Field test Cologne

3.1.1. Overview of activities

Table 5 Overview of activities at EWI

Target group	EQF Level	Time line (from)	Activity	Main stakeholders	Part/s of Blueprint Strategy tested	Results delivered to EC	Energy (or other technological) sector	Contents
Companies interested in trainings for own employees	4-5	Running	**EWI Academy**	EWI Companies affected by energy transition and markets	levers to reduce skills gaps, general templates, best practices		all-round view on the energy value chain	modularized lectures on different contents of the energy value chain; booked by companies as trainings for employees who are new to the energy domain or interested in trainings on specific topics: -electricity value chain (basics) -hydrogen economy (basics) -e-mobility (basics) -scenario generation (advanced) -energy system modelling (advanced)
Professionals with min. 3 years postgraduate work experience	7	WS23	**Certificate Programme Smart Energy – Mastering the Energy Landscape of the Future**	Prof. Marc-Oliver Bettzüge, EWI Cologne Business School	levers to reduce skills gaps, TBD		energy economics, business administration digitalisation	Certificate programme for on different aspects of the energy sector's digitization. Several modules (Energy Business, Smart Home, Smart city) and a capstone project
University student	6	SS23	**Certificate in Future Energy Business**	Prof. Marc-Oliver Bettzüge, EWI EWI e.V: 11 companies out of the energy field	levers to reduce skills gaps, TBD	Skills and knowledge levels will be in line with EQF frameworks	energy economics, business administration digitalisation	two-semester programme for students interested in energy; blend of theoretical contents on energy economics and relevant research methods combined with two practical projects in collaboration with energy companies

3.1.2. Description of activities

3.1.2.1. EWI Academy

The EWI Academy is a training program designed for companies that want to train their employees in the field of energy. The program consists of several modules on different contents of interest related to the digitization-driven transition of the energy sector. The addressees of the EWI Academy are companies, both on the supply- and demand-side, that are willing to offer training to their employees on different carrier stages. The programs' modules are offered online and in-person, combining input sessions with active parts, such as discussions. Besides lectures, the courses can be accompanied by interactive workshop sessions. The modularized structure allows adjusting each training program content- and process-wise to the needs of the companies. E.g., the training can be held on a single day or in multiple day sessions. The training's language is German or English. Participants receive a proof of certification.

So far, a one day crash course was held on about e-mobility, including an interactive workshop session, where participants evaluated business cases on e-mobility. A four-day course on energy management is planned for January and February 2023.

Program fact sheet

1. **Name of program:** EWI Academy
2. **Program format:** On site or online
3. **Program language:** German/English
4. **Length of program:** Each module lasts between 1 day - 4 days
5. **Student´s estimated effort in working hours:** 8-32 hours.
6. **Industrial challenges addressed 1. - Economic and organizational:** Business model adaptation, high economic costs
7. **Industrial challenges addressed 2. – Social:** acceptance of new technologies, lack of citizen engagement
8. **Industrial challenges addressed 3. - Technical and regulatory:** lack of adequate skills from employees, data management
9. **Industrial challenges addressed 4. - Energy system:** network planning: load profiles
10. **Industrial challenges addressed 5. - Extreme situations:** Yes, Extreme weather
11. **Industrial challenges addressed 6. – Other:** N/A
12. **Skill gap area:** Programming and development competences, Data management and analysis
13. **ISCED code of program content:**
    a. **#1:** 0713 Electricity and energy
    b. **#2:** 0613 -Software and applications development and analysis
    c. **#3:** 0712- Environmental protection technology
14. **Starting point of program design:** Energy program with an ICT add-on
15. **Funding 1. - Available for free:** No
16. **Funding 2. - Types of funding:** Corporate funding
17. **Target groups:** Employees (Mid-career stage)
18. **EQF level:** 4-5
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? Yes
    b. Does the program provide credits (ECTS)? No
    c. Is it modularized? Yes
    d. Does it provide any certification per module? yes
20. **Certification:** Certificate of Accomplishment

Business and operational model

1. **Relevance of program:**
    a. **#1:** Understand the concepts and challenges related to the energy transition
    b. **#2:** Understand the role of digitization in the energy transition.
    c. **#3:** Develop new business opportunities in the energy sector
    d. **#4:** Promote energy modelling.
    e. **#5:** Help companies to **de**velop a skilled labour force that understand the energy sector.

2. **Definition of targets:**
    a. Name the skills you target: electricity and energy, database and network design and administration
    b. Enter their ESCO codes: 0713, 0612
    c. Name the occupations you target: Electrotechnology engineer, Management and organisation analysts, Policy administration professionals
    d. Enter their ESCO codes: 215, 2421, 2422
    e. Name the tools and systems that you target: N/A
3. **Financial structures:** N/A
4. **Use of resources:**
    a. **#1:** Laptop and projector
    b. **#2:** EWI classroom or virtual room (MS teams)
    c. **#3:** 2 EWI employees per course.
5. **Licenses for digital tools:** No
6. **Marketing and student recruiting procedures:**
    a. **#1:** Advertising to EWI customers
    b. **#2:** EWI Academy homepage
    c. **#3:** Advertising via energy email list server (Strommarktverteiler)
7. **Employer feedback: /**
8. **Alumni engagement:**
    a. **#1:** Use Alumni as testimonials on the website.
    b. **#2:** Advertise follow-up modules to alumni
    c. **#3:** receive feedback for the course

Learning and teaching model

1. **Admission requirements:** Working experience
2. **Training goals:**
    a. **Training goal #1:** Understand the regulatory framework of energy markets.
    b. **Training goal #2:** Understand electricity, gas and heating grid infrastructure.
    c. **Training goal #3:** Understand new business opportunities in the energy markets.
    d. **Training goal #4:** Understand the importance of scenarios and know how to interpret them.
    e. **Training goal #5:** Understand the next steps of the energy transition towards carbon neutrality.
3. **Program content - Syllabus elements in ICT/ Digital:**
    a. **#1:** INFORMATION TECHNOLOGY: Blockchain
    b. **#2:** MODELLING; SIMULATION,OPTIMISATION: MODELLING; SIMULATION,OPTIMISATION
    c. **#3:** MODELLING; SIMULATION,OPTIMISATION: – Simulation tools
4. **Program content - Syllabus elements in another STEM than ICT/Digital:** N/A
5. **Program content - Syllabus elements in Energy:**
    a. **:** ENERGY MANAGEMENT & GREEN SKILLS – Energy Transition
    b. **#2:** ENERGY MANAGEMENT & GREEN SKILLS: Sustainable Transportation, E-mobility
    c. **#3:** ELECTRICAL POWER SYSTEMS – Grid Development in the area of Smart Grids
    d. **#4:** ENERGY MANAGEMENT & GREEN SKILLS: Regulation & New Business Models
    e. **#5:** ELECTRICAL POWER SYSTEMS – RES (Solar Energy, wind energy)
6. **Program content - Syllabus elements in transversal skills:**
    a. **#1:** MANAGEMENT & BUSINESS: Economy of Energy, Markets and Regulation
    b. **#2:** HUMANITIES & ETHICS: critical thinking
7. **Program content - Re-use of training modules:** not decided yet
8. **Program content - Intellectual Property Rights:** N/A
9. **Methodologies:** Magistral lecturing, Interactive lecture, Discussion-based learning
10. **Teaching methods:** Magistral lectures,
11. **Evaluation methods:** other: attendance.
12. **Internships:** No
13. **Scheduling:** N/A

Program Content

In the different courses in the EWI Academy, students are asked to understand the energy system and critically assess current development and challenges. Hereby, regulatory challenges of energy policies are highlighted and future business cases and development discussed. Different forms of energy, such as electricity, gas, H2, etc. and their properties are discussed. Special attention will be paid to the topics of decentralization and digitization. Besides the supply side, some courses focus on the demand, by e.g. focusing on electric vehicles.

The program is organized and hosted by EWI. Sessions will be led by an EWI manager and an EWI research associate. The program of the EWI academy consists of the following courses in Table 6, which can be taken individually, or subsequently, depending on the educational needs of the customers.

The program consists of five modules, which can be taken separately and jointly, depending on a company's needs. The modules consist of the following courses:

Table 6 Courses in EWI academy

1	Energy Economics Compact	Dr. Johanna Bocklet; Nicole Niesler/Jakob Junkermann	EWI
2	Crash Course Energy Scenarios	Philipp Kienscherf, Arne Lilienkamp	EWI
3	Compact Course Energy Scenarios and Energy System Modelling,	Dr. Johanna Bocklet/ Philipp Kienscherf, TBD	EWI
4	Crash Course Hydrogen Economy	David Schlund, TBD	EWI
5	Crash Course E-Mobility	Philipp Kienscherf, Philip Theile/Arne Lilienkamp	EWI

3.1.2.2. Certificate in Future Energy Business

Companies need qualified applicants to fill relevant open positions to cope with the transformation of energy systems. Addressing this by targeting to close the gap between academia and practice, the Future Energy Certificate is an extra curriculum education offers that focuses on specific preconditions for working in the energy sector. It seeks to reduce the mismatch between the needed qualifications in the energy sector and the ones applicants offer after graduating from university.

The program consists of several courses that EWI and participating companies offer. This approach ensures the practical relevance of the curriculum. Companies have the incentive to engage in teaching to position themselves as potential employers for the participants. By this approach, addressees of the program are students and companies from the energy sector. EWI is responsible for theoretical lectures on energy economics, for the administration, the communication between participants and companies, and the quality of this educational program.

In general, there are two curriculum segments: lectures and projects. Lecture-wise, the program offers courses on energy economics, future energy perspective, and methods and skills (39 hours). Additionally, it consists of two projects organized by participating companies (60 hours).

Program fact sheet

1. **Name of program:** Certificate in Future Energy Business
2. **Program format:** On site
3. **Program language:** German
4. **Length of program:** 1 year
5. **Student´s estimated effort in working hours:** 99 hours
6. **Industrial challenges addressed 1. - Economic and organizational:** Goals/target tracking
7. **Industrial challenges addressed 2. – Social:** acceptance of new technologies
8. **Industrial challenges addressed 3. - Technical and regulatory:** lack of adequate skills from employees

9. **Industrial challenges addressed 4. - Energy system:** Customers: Remote metering, Network planning: Digital tools for network planning, Network planning: Load profiles; Network operation: Short-term load forecasting
10. **Industrial challenges addressed 5. - Extreme situations:** Yes, Extreme weather
11. **Industrial challenges addressed 6. –** Other: energy transition due to war in Ukraine/
12. **Skill gap area:** Big data**,** Programming and development competencies, Data management and analysis
13. **ISCED code of program content:**
    a. **#1:** 0713 Electricity and energy
    b. **#2:** 0588 -interdisciplinary programs and qualifications involving natural science, mathematics and statistics
    c. **#3:** 0712- Environmental protection technology
14. **Starting point of program design:** Energy program with an ICT add-on
15. **Funding 1. - Available for free:** No
16. **Funding 2. - Types of funding:** individual
17. **Target groups:** Students (pre-career stage)
18. **EQF level:** 6
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? Yes
    b. Does the program provide credits (ECTS)? No
    c. Can you study parts of the program? no
    d. Does it provide any certification per module? no
20. **Certification:** Certificate of Accomplishment

Business and operational model

1. **Relevance of program:**
    a. **#1:** Understand the concepts and challenges related to the energy transition
    b. **#2:** Work on real world problems and connect with industry experts
    c. **#3:** Develop new business opportunities in the energy sector
    d. **#4:** Combine theoretical knowledge with practical experience.
    e. **#5:** Help companies to develop a skilled labour force that understand the energy sector.
2. **Definition of targets:**
    a. Name the skills you target: electricity and energy, database and network design and administration
    b. Enter their ESCO codes: 0713, 0612
    c. Name the occupations you target: Electrotechnology engineer, Management and organisation analyst, Policy administration professionals
    d. Enter their ESCO codes: 215, 2421, 2422
    e. Name the tools and systems that you target: N/A
3. **Financial structures:**
    a. **#1:** participating companies pay between 4500-6000€ a year to be part of the program.
    b. **#2:** Students pay 100€ for one year (in order to reduce the drop-out rate)
    c. **#3**: Further expensive are sponsored by the EWI sponsoring associating.
4. **Use of resources:**
    a. **#1:** Laptop and projector
    b. **#2:** EWI classroom or on site a participating companies
    c. **#3:** 2 EWI employees per course or 2 company representatives.
5. **Licenses for digital tools:** No
6. **Marketing and student recruiting procedures:**
    a. **#1:** Advertise at university lectures at University of Cologne and surrounding universities
    b. **#2:** homepage – to be designed.
    c. **#3:** Blackboard at the University
    d. **#4:**EWI website
7. **Employer feedback:** N/A
8. **Alumni engagement:**
    a. **#1:** Use Alumni as testimonials on the website.
    b. **#2:** Create alumni network
    c. **#3:** receive feedback for the course

d. **#4:** create email list server for job announcement and follow up courses

Learning and teaching model

1. **Admission requirements:** Bachelor's degree
2. **Training goals:**
   a. **Training goal #1:** Understand the regulatory framework of energy markets.
   b. **Training goal #2:** Understand electricity, gas, and heating grid infrastructure.
   c. **Training goal #3:** Understand new business opportunities in the energy markets.
   d. **Training goal #4:** Understand the challenges of businesses in the energy field.
   e. **Training goal #5:** Develop a new mindset on design thinking and change management.
3. **Program content - Syllabus elements in ICT/ Digital:**
   a. **#1:** PROGRAMMING LANGUAGES: Programming Principles, basics & fundamentals
   b. **#2:** INFORMATION TECHNOLOGY: New trends in Information technology
   c. **#3:** MODELLING; SIMULATION, OPTIMISATION: – Simulation tools
   d. **#4:** MODELLING; SIMULATION,OPTIMISATION: MODELLING; SIMULATION,OPTIMISATION
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
   a. **#1:** BASIC MECHANICS: Thermodynamics
5. **Program content - Syllabus elements in Energy:**
   a. **#1:** ENERGY MANAGEMENT & GREEN SKILLS – Energy Transition
   b. **#2:** ENERGY MANAGEMENT & GREEN SKILLS: Sustainable Transportation, E-mobility
   c. **#3:** ELECTRICAL POWER SYSTEMS – Grid Development in the area of Smart Grids
   d. **#4:** ENERGY MANAGEMENT & GREEN SKILLS: Regulation & New Business Models
   e. **#5:** ELECTRICAL POWER SYSTEMS – RES (Solar Energy, wind energy)
   f. **#6:** ENERGY MANAGEMENT & GREEN SKILLS: Sustainable Development
   g. **#7:** ENERGY MANAGEMENT & GREEN SKILLS: Flexible demand and smart home/building
6. **Program content - Syllabus elements in transversal skills:**
   a. **#1:**ENGINEERING, PROJECTS & REPORTS: Field Management Project
   b. **#2:** MANAGEMENT & BUSINESS: Economy of Energy, Markets and Regulation
   c. **#3:** TRANSVERSAL PROFESSION SKILLS: Problem Solving
   d. **#4:** TRANSVERSAL PROFESSION SKILLS: Leadership & Change Management
   e. **#5:** HUMANITIES & ETHICS: critical thinking
7. **Program content - Re-use of training modules:** Theoretical lectures from EWI will be partially reused in the EWI academy program
8. **Program content - Intellectual Property Rights:**
9. **Methodologies:** Practical learning Project-based learning, Magistral lecturing, Interactive lecture, Discussion-based learning, Collaborative learning
10. **Teaching methods:** Magistral lectures, Projects, Personal study, Problem solving
11. **Evaluation methods:** Projects.
12. **Internships:** No
13. **Scheduling:** weekend attendance

Program Content

The certificate in the future energy business is a two-semester course designed to bridge the gap between theoretical knowledge in energy economics and practical challenges from companies in the energy business. Students have to take 39 credits and do two field projects (60 credits in total). 1 credit is equivalent to 1 hour of work. Students can select from a wide range of courses, which will be taught by lectures from EWI and/or practitioners from the energy field. So far, the course program consists of the following courses:

Table 7 Course program for certificate in future energy business

1	Introduction to electricity markets	EWI	EWI
2	Introduction to gas markets	EWI	EWI
3	The future of hydrogen	Consulting firm 1	EWI
4	Introduction to the building sector	EWI	EWI
5	Climate change and energy meteorology	University of Cologne	EWI
	Introduction to energy modelling	EWI	EWI
	Current Topics of Energy Market Regulation	Company from the transportation sector	On site
	E-Mobility	Local utility company 1	On site
	Wind energy	Local utility company 1	On site
	Solar energy	Local utility company 1	On site
	Digital business models in the energy sector	Local utility company 2	EWI
	Renewable Energies – Sales Strategies	Consulting firm 1	EWI
	Energy Trading	Trading firm	On site
	Introduction to the history of energy law	Grid company 1	On-site
	Introduction to the electricity grid	Grid company 2	On-site
	The future of mobility	Local utility company 1	On site
	The future of the building sector	Heating manufacturer	On site
	The future of the energy sector	Local utility company 1	On site
	Energy Trading strategies	Trading firm	On-site
	Social Corporate Responsibility and Sustainability	Local utility company 1	On site
	Change Management	Consulting firm	EWI

3.1.2.3. Smart Energy Certificate Programme

The fast transition of the energy sector, combined with digitization, puts pressure on existing business models. However, at the same time, it brings new opportunities. Companies need new knowledge in management positions to leverage untapped business potentials. The Certificate targets employees with at least 3 years of working experience who want to deepen their knowledge on digitalisation and energy economics.

Program fact sheet

1. **Name of program:** Smart Energy Certificate Programme
2. **Program format:** online
3. **Program language:** English
4. **Length of program:** 5 month
5. **Student´s estimated effort in working hours:** 40 hours
6. **Industrial challenges addressed 1. - Economic and organizational:** Business Model Adaptation
7. **Industrial challenges addressed 2. – Social:** acceptance of new technologies
8. **Industrial challenges addressed 3. - Technical and regulatory:** lack of adequate skills from employees

9. **Industrial challenges addressed 4. - Energy system:** Customers: Remote metering, Network planning: Digital tools for network planning, Network planning: Load profiles; Network operation: Short-term load forecasting
10. **Industrial challenges addressed 5. - Extreme situations:** No
11. **Industrial challenges addressed 6. – Other**: N/A
12. **Skill gap area:** Big data**,** Programming and development competences, Data management and analysis
13. **ISCED code of program content:**
    a. **#1:** 0713 Electricity and energy
    b. **#2:** 0610 Information and communications technologies not further specified
    c. **#3:** 0712- Environmental protection technology
14. **Starting point of program design:** both
15. **Funding 1. - Available for free:** No
16. **Funding 2. - Types of funding:** individual
17. **Target groups:** Employees (mid-career stage)
18. **EQF level:** 7
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? Yes
    b. Does the program provide credits (ECTS)? No
    c. Can you study parts of the program? No
    d. Does it provide any certification per module? No
20. **Certification:** Professions Certification (through the cologne business school)

Business and operational model

1. **Relevance of program:**
    a. **#1:** Understand the concepts and challenges related to the energy transition
    b. **#2:** Comprehend the role of digitalisation for the energy transition.
    c. **#3:** Develop new business opportunities in the energy sector
    d. **#4:** Combine theoretical knowledge with practical experience**.**
    e. **#5:** Help companies to develop a skilled labour force that understand smart technologies and the energy sector.
2. **Definition of targets:**
    a. Name the skills you target: electricity and energy, database and network design and administration
    b. Enter their ESCO codes: 0713, 0612
    c. Name the occupations you target: Electrotechnology engineer, Management and organisation analysts, Policy administration professionals
    d. Enter their ESCO codes: 215, 2421, 2422
    e. Name the tools and systems that you target: N.A
3. **Financial structures:**
    a. **#1:** Students need to pay to participate in the programme.
    b. **#2:** Sponsorships can be applied to via the Cologne Graduate School
4. **Use of resources:**
    a. **#1:** E-Learning platform
    b. **#2:**virtual classroom (MS Teams)
5. **Licenses for digital tools:** No
6. **Marketing and student recruiting procedures:**
    a. **#1:** Advertising through the Cologne Graduate School
    b. **#2:** Reach out to EWI customers and advertise educational programme.
    c. **#3:** EWI Website
    d. **#4:** Email list server (Strommarktverteiler)
7. **Employer feedback:** N/A
8. **Alumni engagement:**
    a. **#1:** Use Alumni as testimonials on the website.
    b. **#2:** Advertise follow-up modules to alumni
    c. **#3:** receive feedback for the course

Learning and teaching model

1. **Admission requirements:** Graduate, Working Experience
2. **Training goals:**
    a. **Training goal #1:** Understand the regulatory framework of energy markets.
    b. **Training goal #2:** Understand the role of digitization and smart technologies for the energy transition.
    c. **Training goal #3:** Understand new business opportunities in the energy markets.
    d. **Training goal #4:** Develop a new mind set on design thinking and change management.
3. **Program content - Syllabus elements in ICT/ Digital:**
    a. **#1** INFORMATION TECHNOLOGY: New trends in Information technology
4. **Program content - Syllabus elements in another STEM than ICT/Digital: /**
5. **Program content - Syllabus elements in Energy:**
    a. **#1:** ENERGY MANAGEMENT & GREEN SKILLS – Energy Transition
    b. **#2:** ENERGY MANAGEMENT & GREEN SKILLS: Sustainable Transportation, E-mobility
    c. **#3:** ELECTRICAL POWER SYSTEMS – Grid Development in the area of Smart Grids
    d. **#4:** ENERGY MANAGEMENT & GREEN SKILLS: Regulation & New Business Models
    e. **#5:** ELECTRICAL POWER SYSTEMS – RES (Solar Energy, wind energy)
    f. **#6:** ENERGY MANAGEMENT & GREEN SKILLS: Sustainable Development
    g. **#7:** ENERGY MANAGEMENT & GREEN SKILLS: Flexible demand and smart home/building
6. **Program content - Syllabus elements in transversal skills:**
    a. **#1:**FOREIGN LANGUAGES: English (mandatory)
    b. **#2:** MANAGEMENT & BUSINESS: Economy of Energy, Markets and Regulation
    c. **#3:** MANAGEMENT & BUSINESS: Project Economics – CAPEX, Cash Flow, Rate of Return
    d. **#4:** TRANSVERSAL PROFESSION SKILLS: Leadership & Change Management
    e. **#5:** HUMANITIES & ETHICS: critical thinking
7. **Program content - Re-use of training modules:** no.
8. **Program content - Intellectual Property Rights:**
9. **Methodologies:** Magistral lecturing, Interactive lecture, Discussion-based learning, case-based learning
10. **Teaching methods:** Magistral lectures, Personal study, Problem solving
11. **Evaluation methods:** Written Examination
12. **Internships:** No
13. **Scheduling:** self-paced

Program Content

The program consists of four modules with different focuses and a capstone project. The program is in English and addresses employees with a minimum of three years of postgraduate work experience. The modules, which applicants can book based on their own interest, are spread over ten days within five months (one semester) and can be taken self-paced.

Depending on the size of the cohort, some of the modules might be aligned with the courses from the Certificate in Future Business Programme to enable exchange between the participants. Modules will cover the following topics: Transforming the Energy Business, Smart Mobility, Smart Customer and Home, Smart City and Infrastructure, Smart Energy Capstone Project

3.1.3. Timeline of activities

The three programs will be planned and implemented in four stages with two different approaches. The EWI Academy was designed content- and organizational-wise according to the best practices gathered in WP4 and the skill gaps defined in WP5 and other work packages. In November, the first session took place. After the first implementation, the concept is currently analysed concerning the intended goals and updated. Next sessions will follow in January and February. After the second implementation, the outcome is analysed again. The other, more extensive programs have a more extended design and implementation phase as they have a longer duration. Thus, they take place only once within the scope of this program. Ultimately, the programs are evaluated thoroughly individually and iterated with the BSDE. In this process, participants' feedback will also be incorporated.

Table 8 Timeline of activities provided by EWI

Activity	Month																	
	03/22	04/22	05/22	06/22	07/22	08/22	09/22	10/22	11/22	12/22	01/23	02/23	03/23	04/23	05/23	06/23	07/23	08/23
EWI Academy																		
Smart Energy Certificate Programme																		
Future Energy Certificate																		

	design
	analysis
	implementation
	assessment

3.2. Field test Athens

Stemming from the development of the Blueprint strategy of the EDDIE project and its different elements, the piloting activities are being designed to test the applicability and relevance of the results. The activities are chosen in order to test a wide range of BSDE parts and reach a variety of target groups.

In this direction, the set of lectures is being developed based on general templates designed in EDDIE project. The identified best practices are a valuable guideline for the content development of the lectures, which are designed aiming to mitigate parts of the skill gaps identified through the project. The whole design process follows the recommendations and overall action set of the BSDE strategy. These lectures will be presented to MSc students in the context of NTUA MSc program "Energy production and management". The program aims to cover a wide range of scientific areas, from conventional & RES production, thermal production and electrical installations to energy economics, energy savings, sustainable environmental management, energy markets and digitalization of energy systems. The lectures will be part of the course "Digitalization of energy systems". An initial presentation of these lectures was conducted during the spring semester 2022 of the MSc program, aiming to receive feedback from the attendants and adjust the content till the final delivery of the lectures in spring semester 2023.

The activities are complemented by a set of introductory lectures/presentations in the MOOC and Summer School developed in the context of ERIGRid 2.0 project (H2020 project). The main goal of ERIGrid 2.0 is to support the research, technology development, and innovation of smart grid and smart energy systems approaches, concepts, and solutions in Europe taking a holistic and cyber-physical systems-based approach into account. In this direction, a MOOC will be designed and developed focusing on advanced validation methods for smart grids, targeting students, researchers and professionals. EDDIE will participate with an introductory lecture, presenting the targets of the project, focusing on the Blueprint strategy and the identified skill gaps, addressing appropriate levers to reduce these gaps between skill demand from the industry and status in education. Accordingly, a Summer School will take place during summer '23, aiming to reach wider audience, with general focus on modern power systems and smart grids. EDDIE will participate in the Summer School with a presentation addressing similar topics with the ones presented in the MOOC.

3.2.1. Overview of activities

Table 9 Overview of activities at NTUA

Target group	EQF Level	Timeline (from)	Activity	Main stakeholders	Part/s of Blueprint Strategy tested	Results delivered to EC	Energy (or other technological) sector	Contents
Master's students	7	June '23	**Lectures on Local energy markets, energy communities and blockchain applications**	NTUA, MSc on Energy production and management, EDDIE	Levers to reduce skills gaps, Design of recommendations and overall action set, general templates, best practices	Digital platforms, Blockchain, computing tools and platforms, mathematical optimization, data analysis	Power	Two 45-minute lectures on local energy markets and blockchain applications
Master's students	7	June '23	**Lectures on AI applications on energy systems: Dynamic security and forecasting**	NTUA, MSc on Energy production and management, EDDIE	Levers to reduce skills gaps, Design of recommendations and overall action set, general templates, best practices	Artificial Intelligence, mathematical optimization, forecasting, data analysis, machine learning	Power	Two 45-minute lectures
Bachelor and master students, professionals	6, 7	Summer '23	**MOOC (cooperation with ERIGrid 2.0 project)**	NTUA, EDDIE, ERIGrid 2.0	TBD	TBD	Power	MOOC
TBD	TBD	Summer '23	**Summer school (cooperation with**	NTUA, EDDIE, ERIGrid 2.0	TBD	TBD	Power	Presentations, educational material, workshops

			ERIGrid 2.0 project)					

3.2.2. Description of activities

3.2.2.1. Lecture on Local energy markets, energy communities and blockchain applications

The lectures will focus on Local Energy Markets (LEM) and the role of blockchain technology in securing the decentralized coordination of distribution grids. The content of the lectures is being developed with the aim to mitigate part of the skill gaps identified through the EDDIE project on the skill gaps that these lectures are targeting, which are digital platforms, blockchain, computing tools & platforms, mathematical optimization and data analysis. This pilot activity will be divided in two 45-minute lectures to MSc students.

Program fact sheet

1. **Name of program:** Lectures on Local energy markets, energy communities and blockchain applications, contained in MSc program "Energy Production and Management" and specifically during the course "Digitalization of energy systems"
2. **Program format:** Blended
3. **Program language:** Greek
4. **Length of program:** Two lectures, 45 minutes each
5. **Student´s estimated effort in working hours:** 2 hours per week for one semester (referring to the course "Digitalization of energy systems")
6. **Industrial challenges addressed 1. - Economic and organizational:** Business model adaptation
7. **Industrial challenges addressed 2. – Social:** privacy concerns, acceptance of new technologies, lack of citizen engagement
8. **Industrial challenges addressed 3. - Technical and regulatory: N/A**
9. **Industrial challenges addressed 4. – Energy system:** remote services to customers, short-term load forecasting, maintenance and asset management
10. **Industrial challenges addressed 5. – Extreme situations: N/A**
11. **Industrial challenges addressed 6. – Other: N/A**
12. **Skill gap area:** Data management and analysis, Big Data, Cybersecurity, Digital platforms, Blockchain, Computing tools & platforms, Mathematical optimization
13. **ISCED code of program content:**
    a. **#1:** 0713 Electricity and energy
14. **Starting point of program design:** Energy program with an ICT add-on & ICT program with an Energy add-on
15. **Funding 1. - Available for free:** Yes
16. **Funding 2. - Types of funding:** N/A
17. **Target groups:** Students (MSc)
18. **EQF level:** 7
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job: Yes
    b. Does the program provide credits (ECTS): Yes
    c. Is it modularized: Partly (referring to the whole MSc program)
    d. Does it provide any certification per module: No

    The course is part of the MSc program, and the adequate understanding of its content is certified through written exams at the end of the semester. The successful completion of the whole MSc program provides students with 60 credits (ECTS)
20. **Certification:** University degree (Master of Science)

Business and operational model

1. **Relevance of program:** Deepening of engineers in techniques and methods of a more integrated interdisciplinary approach, research and treatment of the individual topics of the energy subject. Training new engineers in the concept of developing new acknowledge through research in this continuously developing field (referring to the whole MSc program)
2. **Definition of targets:**
    a. **#1:** Name the skills you target: Algorithms, Blockchain, Operations research, logistics, Game Theory, Regulation & new Business Models, Flexible demand and Smart home/buildings, Energy Transition, Economy of Energy, Markets and Regulation, Modelling, simulation & optimisation
    b. **#2:** Enter their ESCO codes:
    c. **#3:** Name the occupations you target: Data analysts (Energy Analyst), Senior Sustainability Consultant, Blockchain engineer (Distributed Ledger Technology), Energy Modeler, Renewable Energy Consultant, Optimization Engineers, Engineer in Mathematical Optimization
    d. **#4:** Enter their ESCO codes: 2511.3, 3112.5, 3112.7, 2433.3, 2512.4.1
    e. **#5:** Name the tools and systems that you target: peer to peer exchange tools, use of simulation tools
3. **Financial structures:** N/A
4. **Use of resources:** the resources needed for the program are just lecture classes
5. **Licenses for digital tools:**
6. **Marketing and student recruiting procedures:**
7. **#1:** informative conferences
8. **#2:** promoting website of the program. Via the website the achievements of graduates of the program, career opportunities and the many fields of energy section studied could be the highlights of a promoting procedure
9. **Employer feedback:** N/A
10. **Alumni engagement:** N/A

Learning and teaching model

1. **Admission requirements:** Bachelor's degree, Master degree - Degree from Greek Polytechnic schools which award 5 year integrated Bachelor and Master's
2. **Training goals:**
    a. Training goal #1: Overview of Local Energy Market stakeholders and components
    b. Training goal #2: Familiarize with the Local Energy Markets formulation examples and with optimization, game theoretic and auction-based models for the Local Energy Markets formation
    c. Training goal #3: Practical understanding of the basic optimization functions for the everyday operation of a Local Energy Market
    d. Training goal #4: Familiarize with the blockchain technology and with Bitcoin and Ethereum structures.
    e. Training goal #5: Analysis of the smart contracts structure and the use of blockchain technology for the facilitation of Local Energy Markets operation
3. **Program content - Syllabus elements in ICT/Digital:**
    a. **#1:** MODELLING, SIMULATION & OPTIMISATION - Modelling, simulation & optimization
    b. **#2:** DATA MODELING - Operations research, logistics, Game Theory
    c. **#3:** INFORMATION TECHNOLOGY – Blockchain
    d. **#4:** PRIVACY: Identification and authentication
    e. **#5:** INFORMATION TECHNOLOGY - New Trends in Information Technology
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
    a. **#1:** MODELLING, SIMULATION & OPTIMISATION - Modelling, simulation & optimization
    b. **#2:** DATA MODELING - Operations research, logistics, Game Theory
5. **Program content - Syllabus elements in Energy:**
    a. **#1:** ENERGY MANAGEMENT & GREEN SKILLS - Flexible demand and Smart home/buildings
    b. **#2:** ENERGY MANAGEMENT & GREEN SKILLS - Energy Transition
    c. **#3:** DATA MODELING - Operations research, logistics, Game Theory
6. **Program content - Syllabus elements in transversal skills:**

   a. **#1:** MANAGEMENT & BUSINESS - Economy of Energy, Markets and Regulation, Regulation & new Business Models
   b. **#2:** TRANSVERSAL PROFESSIONAL SKILLS – Computer Technology
7. **Program content – Re-use of training modules:** Yes, in the lectures of the course for the upcoming years of the MSc program
8. **Program contents – Intellectual Property Rights:** All contents are protected by copyright, They may only be used within the limited circle of participants of the Moodle learning room and for private purposes. Sharing the content beyond the limited group of participants in the Moodle learning room thus constitutes publication subject to permission
9. **Methodologies:** Problem-based learning, Scenario-based learning, Case-based learning
10. **Teaching methods:** Lectures
11. **Evaluation methods:** written examination
12. **Internships:** Yes. The program provides the students in the last year with career opportunities, providing information for job vacancies in several energy entities.
13. **Scheduling:** evening attendance (off-business hours, targeting also professionals)

Program Content

The lectures on Local energy markets, energy communities and blockchain applications consist of two lectures, one on “local energy markets in the context of smart grids” and one on “Securing the Decentralized Coordination of Active Distribution Grids with Blockchain”.

The first lecture initially contains an overview on smart grids structure, Demand Side Management components and benefits and flexibility concept map, followed by the basic structure of the Greek energy market and the relevant stakeholders. Energy Communities as a key-role part of the future energy markets are being presented. Greece is one of the first countries among European Union to adopt the EU directive for energy communities in its regulatory framework. Therefore, a short analysis of the relevant law is presented, focusing on the key targets, activities and benefits, as well as the potential beneficiaries and the trading methods of energy communities. The overview is followed by a more detailed analysis on the trading methods inside LEMs and peer-to-peer trading. An indicative map of LEM formulation examples, separated according to their main purposes in optimization, game theoretic and auction-based models. Each model is briefly described focusing on its main target.

Figure 9 Local Energy Markets formulation examples

The first lecture ends with a simple example of a LEM and a case study, in order to familiarize the students with the problem of optimization. The case study includes an approach of the operation of a LEM. The basic variables and functions of the optimization problem are presented and explained, including flexibility equations and the standard values of the simulations. Then, the results of the simulation are shown, aiming to prove the benefits of all the relevant stakeholders participating in the LEM, compared to acting alone.

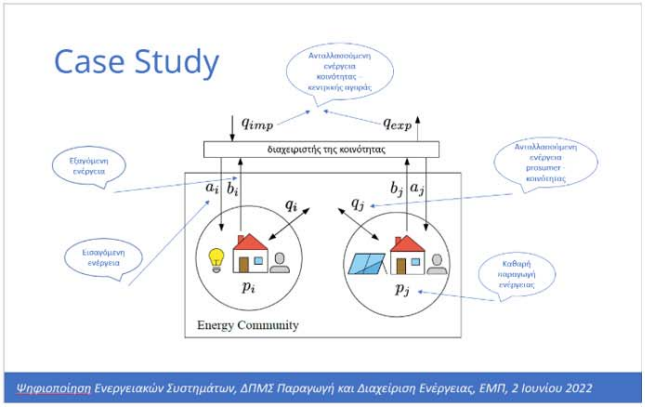


Figure 10 Case study and energy exchanges

The second lecture initially contains an overview of distributed computer network protocols and blockchain technologies. The example of Bitcoin is presented and analysed to familiarize the students with the procedures of introducing new blocks of data, changing state and the relevant consensus mechanisms. Subsequently, aiming to explain the smart contracts' structure, Ethereum is presented, as a global decentralized computing infrastructure. Special focus is given to contract account activation, nodes function and the computation costs. In order to connect smart contracts with energy markets, the terms of transactive energy & decentralized energy markets are analysed, connected to the advantages provided for transactions in Energy markets. To further enlighten the role of blockchain technology, two examples are developed. The first refers to a practical decentralized application, where the operator of a LEM is replaced by a protocol. The main security assumptions and the basic modelling of the protocol with the use of smart contracts are described, followed by an overview of the simulation results and conclusions.

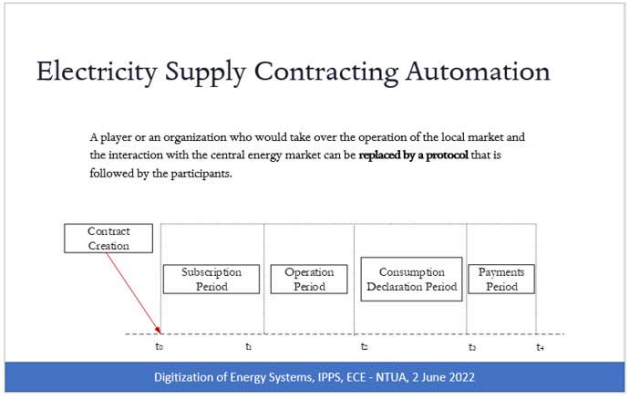


Figure 11 A practical decentralized application enabling smart contracts

The second example involves an Ethereum-based application for the facilitation of an LEM of an energy community. The main target is the optimal match of local consumption with production. The model used for the simulation is a double auction negotiation. The lecture ends with the presentation of the simulation's indicative results and conclusions.

3.2.2.2. Lectures on AI applications on energy systems: Dynamic security and forecasting

The lectures will focus on AI applications on energy systems and specifically on dynamic security and forecasting. The content of the lectures is developed based on artificial Intelligence, mathematical optimization, forecasting, data analysis, machine learning as identified skill gaps. This pilot activity will be divided in two 45-minute lectures to MSc students.

Program fact sheet

1. **Name of program:** Lectures on AI applications on energy systems: Dynamic security and forecasting, contained in MSc program "Energy Production and Management"
2. **Program format:** Blended
3. **Program language:** Greek
4. **Length of program:** Two lectures, 45 minutes each
5. **Student´s estimated effort in working hours:** 2 hours per week for one semester (referring to the course "Digitalization of energy systems")
6. **Industrial challenges addressed 1. - Economic and organizational: Goals/target-tracking**
7. **Industrial challenges addressed 2. – Social:** acceptance of new technologies
8. **Industrial challenges addressed 3. - Technical and regulatory:** Reliability and stability need for machine-to-machine communication, data management, Technology integration
9. **Industrial challenges addressed 4. - Energy system:** Network operation: Data for longer term load forecasting, Short term load forecasting, Predictive maintenance
10. **Industrial challenges addressed 5. – Extreme situations:** N/A
11. **Industrial challenges addressed 6. – Other:** N/A
12. **Skill gap area:** Data management and analysis, Big Data, Programming and development competences, Artificial Intelligence, Mathematical optimization, Forecasting, Machine learning
13. **ISCED code of program content:** 713 Electricity and energy
14. **Starting point of program design:** Energy program with an ICT add-on & ICT program with an Energy add-on
15. **Funding 1. - Available for free:** Yes
16. **Funding 2. - Types of funding:** N/A
17. **Target groups:** Students (MSc)
18. **EQF level: 7**
19. **Lifelong learning and certification:**
    a. **Is it possible to combine the program with a job:** Yes
    b. **Does the program provide credits (ECTS):** Yes
    c. **Is it modularized:** Partly (referring to the whole MSc program)
    d. **Does it provide any certification per module:** No
    The course is part of the MSc program, and the adequate understanding of its content is certified through written exams at the end of the semester. The successful completion of the whole MSc program provides students with 60 credits (ECTS)
20. **Certification:** University degree (Master of Science)

Business and operational model

1. **Relevance of program:** Deepening of engineers in techniques and methods of a more integrated interdisciplinary approach, research and treatment of the individual topics of the energy subject. Training new engineers in the concept of developing new acknowledge through research in this continuously developing field (referring to the whole MSc program)
2. **Definition of targets:**
    a. **Name the skills you target:** Dynamic systems, Control systems, Modelling, simulation & optimization, Mathematics for engineering & technology, Assembly Management of RES, Machine Learning for Engineers
    b. **Enter their ESCO codes:** N/A
    c. **Name the occupations you target:** systems integration engineer, simulation engineer, AI and ML engineer, machine learning engineer, optimization engineer
    d. **Enter their ESCO codes:** 2511.17, 2511.11
    e. **Name the tools and systems that you target:** distribution management tools, intelligent maintenance systems, use of simulation tools
3. **Financial structures:** N/A
4. **Use of resources:** The resources needed for the program is just lecture classes.
5. **Licenses for digital tools:** N/A
6. **Marketing and student recruiting procedures:**
    a. **#1:** informative conferences

b. **#2:** promoting website of the program. Via the website the achievements of graduates of the program, career opportunities and the many fields of energy section studied could be the highlights of a promoting procedure

7. **Employer feedback:** N/A
8. **Alumni engagement:** N/A

Learning and teaching model

1. **Admission requirements:** Bachelor's degree, Master degree - Degree from Greek Polytechnic schools which award 5 year integrated Bachelor and Master's
2. **Training goals:**
   a. Training goal #1: Familiarize with machine learning and dynamic control of power systems principles, as well as with the crucial role that machine learning can play in dynamic control of future power systems.
   b. Training goal #2: Analysis of machine learning logic, regarding training sets, classifiers, decision trees and the evaluation procedure.
   c. Training goal #3: Familiarize with wind & solar power predictions and its mathematical formulation
   d. Training goal #4: Understanding of artificial neural networks starting from basic approach to deep learning.
   e. Training goal #5: Focus on evaluation process for the efficiency of the training sets and the basic evaluation metrics.
3. **Program content - Syllabus elements in ICT/Digital:**
   a. **#1:** MODELLING, SIMULATION & OPTIMISATION - Modelling, simulation & optimization
   b. **#2:** MODELLING, SIMULATION & OPTIMISATION – Statistics
   c. **#3:** MACHINE LEARNING - machine learning for engineers
   d. **#4:** CONTROL - Control systems
   e. **#5:** CONTROL - Digital control
   f. **#5:** CONTROL - Remote control & Automation
   g. **#6:** PROGRAMMING LANGUAGES - Algorithms
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
   a. **#1:** MODELLING, SIMULATION & OPTIMISATION - Modelling, simulation & optimization
   b. **#2:** MODELLING, SIMULATION & OPTIMISATION – Statistics
   c. **#3:** CONTROL - Control systems
   d. **#4:** CONTROL - Digital control
   e. **#5:** CONTROL - Remote control & Automation
   f. **#2:** DATA MODELING - Operations research, logistics, Game Theory
   g. **#3:** Basic Maths - Mathematics for engineering & technology
5. **Program content - Syllabus elements in Energy:**
   a. **#1:** ENERGY MANAGEMENT & GREEN SKILLS RES (Solar Energy, Wind Energy)
6. **Program content - Syllabus elements in transversal skills:**
   a. **#1:** TRANSVERSAL PROFESSIONAL SKILLS – Computer Technology
7. **Program content – Re-use of training modules:** Yes, in the lectures of the course for the upcoming years of the MSc program
8. **Program contents – Intellectual Property Rights:** All contents are protected by copyright, They may only be used within the limited circle of participants of the Moodle learning room and for private purposes. Sharing the content beyond the limited group of participants in the Moodle learning room thus constitutes publication subject to permission
9. **Methodologies:** Problem-based learning, Scenario-based learning, Case-based learning
10. **Teaching methods:** Lectures
11. **Evaluation methods:** written examination
12. **Internships:** Yes. The program provides the students in the last year with career opportunities, providing information for job vacancies in several energy entities.
13. **Scheduling:** evening attendance (off-business hours, targeting also professionals)

Program Content

The lectures on AI applications on energy systems: dynamic security and forecasting consists of two lectures, one on “Application of supervised machine learning for dynamic safety assessment in electrical power systems” and one on “Introduction to RES production forecasting”.

The first lecture starts with basic information about machine learning regarding its principal characteristics, the reasons that machine learning is used in power systems and the relevant challenges, as well as basic information about dynamic safety of electrical power systems regarding safety assessment, load flow analysis, dynamic simulations and the challenges of dynamic safety assessment addressed through an adequate example. After this information it is made clear which are the benefits that machine learning will provide in the dynamic safety assessment of power systems. Therefore, the concepts of creating training sets, the selection of the method, the training and evaluation of the classifiers for the application in the assessment of the system’s safety are presented. In this procedure, the training sets are crucial and therefore they will further be analysed, focusing on classifiers performance and the techniques for estimating the most suitable training sets.

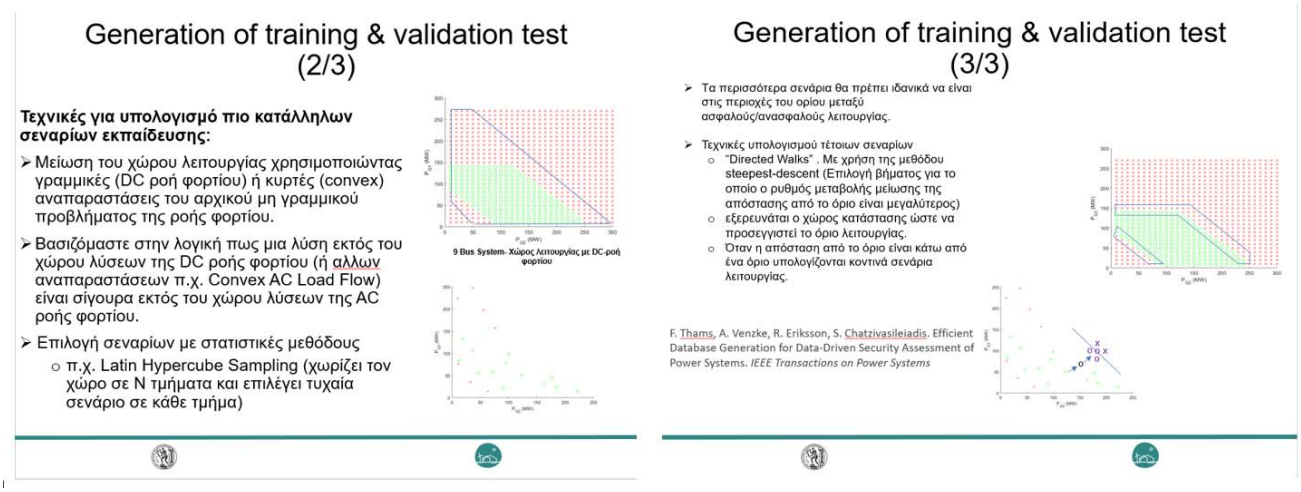


Figure 12 Generation of training & validation test

The following slides include the analysis of supervised learning algorithms, presenting various classification methods, such as decision trees, artificial neural networks and the support vendor machines, with further details concerning decision trees and optimal classification trees.

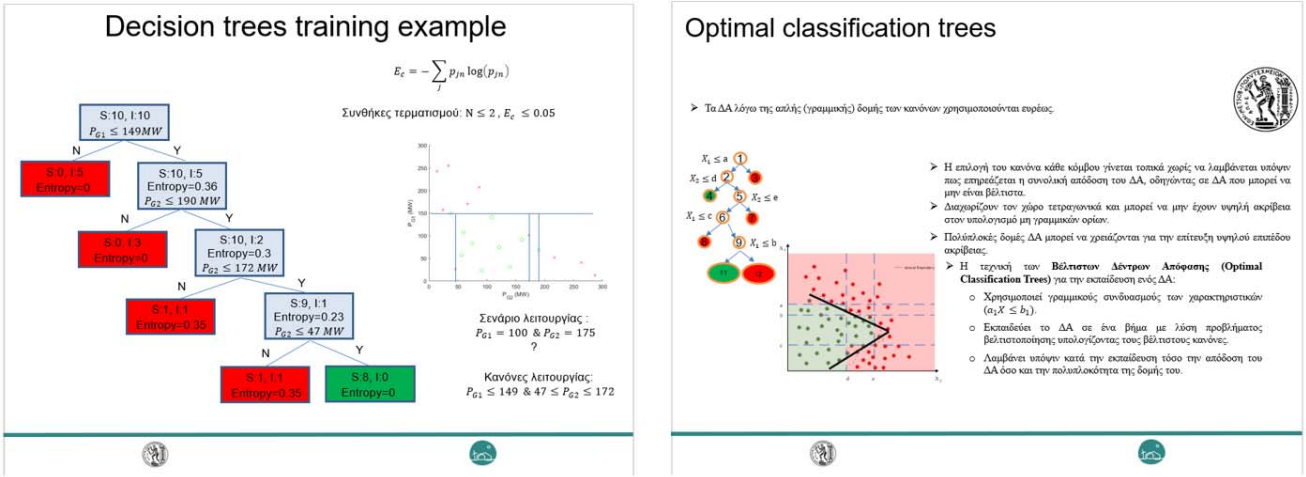


Figure 13 Examples of decision trees training and optimal classification trees

The lecture summarizes the content with a practical example of classifiers application and comparison in the power system of a non-interconnected Greek island. The basic parameters of the system are described in order to generate the training set and then the training time and the accuracy of the different classifiers are shown and

compared, resulting to the evaluation of the machine learning techniques in dynamic security of power systems and a short reference to the advanced evaluation techniques.

The second lecture starts with an introduction to power predictions, stating the meaning, necessity, relevant stakeholders and basic function mechanism of wind and solar power predictions, followed by the challenges connected to power prediction. The introduction is supplemented by the mathematical formulation of forecasting basic principles, considering the power conversion functions. Artificial neural networks are a crucial part of the forecast procedure, and therefore the training process of the artificial neural network, combined with the inputs and error functions is presented. For further understanding of this process, an example of a single hidden layer neural network is analysed, introducing forward pass, calculating error and gradient descent. The lecture then combines the aforementioned information into an actual power forecasting example with the use of artificial neural networks. The basic approach of single layer is then expanded to deep learning, presenting the full advantages of neural networks in wind & solar power forecasting.

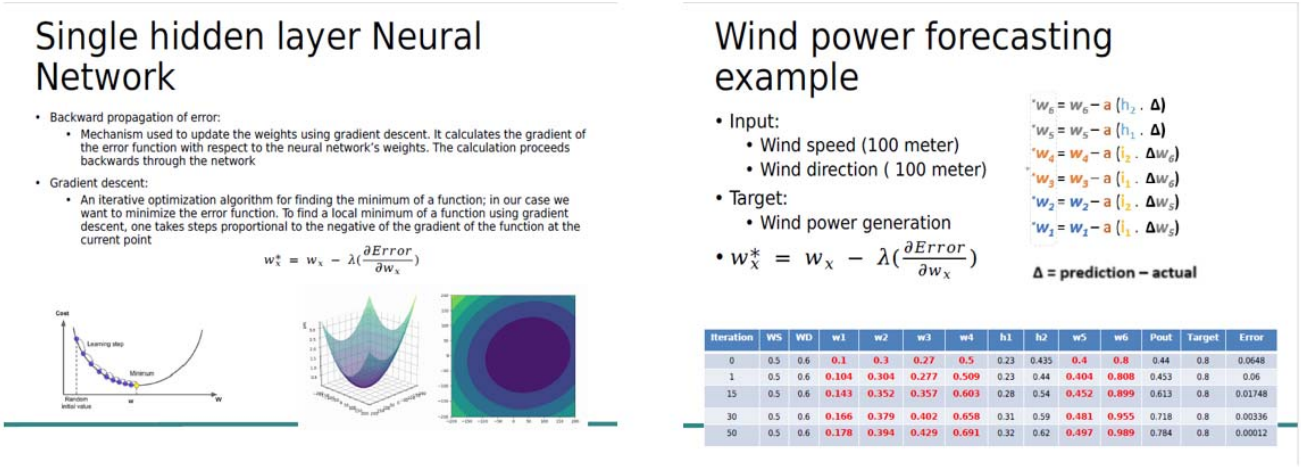


Figure 14 Single hidden layer Neural Network and forecasting example

The training process of the model is followed by the evaluation of the developed model, presenting the need of evaluation and the basic evaluation metrics (bias, mean absolute error, mean square error, root mean square error). These metrics are further analysed, presenting the equations and outcomes of the evaluation for each metric. The lecture ends with an application of the various metrics into the evaluation of a power prediction example.

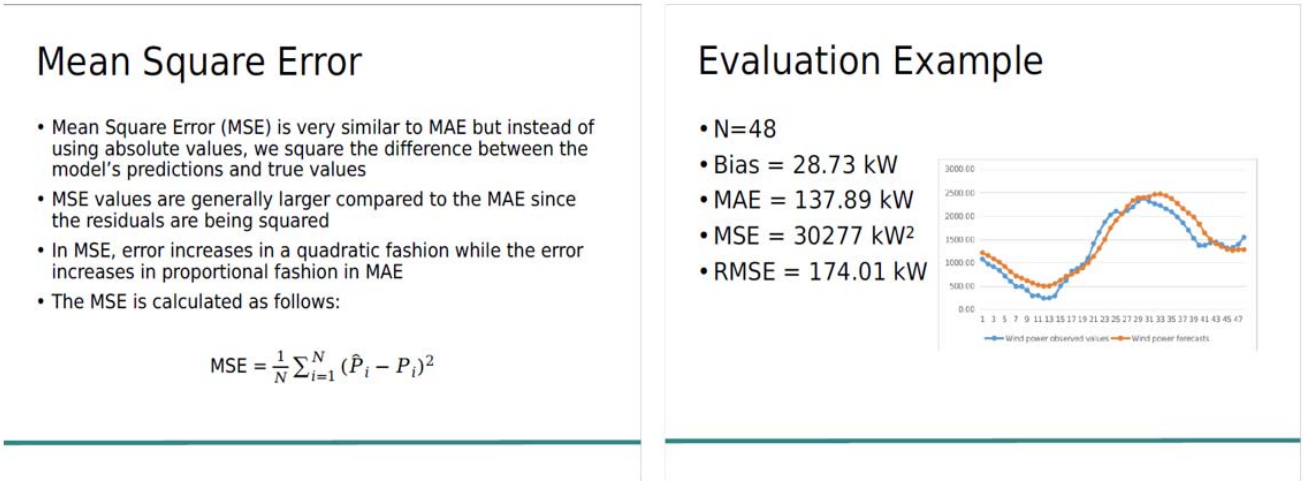


Figure 15 Evaluation metrics example and simulation results

3.2.2.3. Introductory lecture into MOOC on advanced validation methods for smart grids

The MOOC will be organized by the H2020 project ERIGrid 2.0 and will focus on the topic of advanced validation methods for smart grids. EDDIE will participate in the MOOC with a lecture raising awareness in the educational challenges that occur due to the digitalization of the energy systems. The lecture will be available to BSc and MSc students, as well as to young professionals and researchers.

Program fact sheet

1. **Name of program:** Advanced validation methods for smart grids
2. **Program format:** Online
3. **Program language:** English
4. **Length of program:** One 45-minutes lecture
5. **Student´s estimated effort in working hours:** 45 minutes
6. **Industrial challenges addressed 1. - Economic and organizational:** Business model adaptation
7. **Industrial challenges addressed 2. – Social:** Acceptance of new technologies
8. **Industrial challenges addressed 3. - Technical and regulatory:** Lack of adequate skills from employees
9. **Industrial challenges addressed 4. - Energy system:** N/A
10. **Industrial challenges addressed 5. - Extreme situations:** N/A
11. **Industrial challenges addressed 6. – Other:**
12. **Skill gap area:** Data management and analysis, Big Data, Cybersecurity, Programming and development competencies
13. **ISCED code of program content:** N/A
14. **Starting point of program design:** N/A
15. **Funding 1. - Available for free:** Yes
16. **Funding 2. - Types of funding:** N/A
17. **Target groups:** students, employees, professionals between jobs
18. **EQF level: 6-7**
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job: Yes
    b. Does the program provide credits (ECTS): No
    c. Is it modularized: Yes
    d. Does it provide any certification per module: No
20. **Certification:** Certification of attendance

Business and operational model

1. **Relevance of program:** N/A
2. **Definition of targets:**
    a. Name the skills you target: N/A
    b. Enter their ESCO codes: N/A
    c. Name the occupations you target: N/A
    d. Enter their ESCO codes: N/A
    e. Name the tools and systems that you target: N/A
3. **Financial structures:** N/A
4. **Use of resources:** N/A
5. **Licenses for digital tools:** N/A
6. **Marketing and student recruiting procedures:** N/A
7. **Employer feedback:** N/A
8. **Alumni engagement:** N/A

Learning and teaching model

1. **Admission requirements: N/A**
2. **Training goals:**
    a. Training goal #1: raising awareness in the educational challenges that occur due the digitalization of the energy systems

   b. Training goal #2: Inform the participants about the identified skill gaps and the basic guidelines of the Blueprint strategy
3. **Program content - Syllabus elements in ICT/Digital:**
   a. **#1:** INFORMATION TECHNOLOGY - New Trends in Information Technology
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
   a. **#1:** ELECTRICAL ENGINEERING – Electrical Engineering
5. **Program content - Syllabus elements in Energy:**
   a. **#1:** ELECTRICAL ENGINEERING – Electrical Engineering
6. **Program content - Syllabus elements in transversal skills:** N/A
7. **Program content – Re-use of training modules:** N/A
8. **Program contents – Intellectual Property Rights**: All contents are protected by copyright, They may only be used within the limited circle of participants of the Moodle learning room and for private purposes. Sharing the content beyond the limited group of participants in the Moodle learning room thus constitutes publication subject to permission.
9. **Methodologies:** N/A
10. **Teaching methods:** N/A
11. **Evaluation methods:** N/A
12. **Internships:** N/A
13. **Scheduling:** N/A

Program Content

The introductory lecture / presentation, during the MOOC, will focus on the emerging needs in the educational sector, as an outcome of the ongoing digitalization procedure of the energy systems. The lecture will include the identified skills gaps and an initial presentation of the Blueprint Strategy of EDDIE project, targeting to meet and anticipate the skills demands of the energy sector.

3.2.2.4. Participation in ERIGrid 2.0 Summer School

The Summer School organized under ERIGrid 2.0 (H2020 project), will take place during summer 2023 and will focus on smart grid applications. EDDIE will participate by organizing a presentation targeting to disseminate the projects' goals and outcomes, facilitated by the training materials developed during the project.

Program fact sheet

1. **Name of program:** Summer school on smart grid applications
2. **Program format:** Online
3. **Program language:** English
4. **Length of program:** One 45-minutes lecture
5. **Student´s estimated effort in working hours:**
6. **Industrial challenges addressed 1. - Economic and organizational:** Business model adaptation
7. **Industrial challenges addressed 2. – Social:** Acceptance of new technologies
8. **Industrial challenges addressed 3. - Technical and regulatory:** Lack of adequate skills from employees
9. **Industrial challenges addressed 4. - Energy system:**
10. **Industrial challenges addressed 5. - Extreme situations:**
11. **Industrial challenges addressed 6. – Other:** N/A
12. **Skill gap area:** Data management and analysis, Big Data, Cybersecurity, Programming and development competencies
13. **ISCED code of program content:** N/A
14. **Starting point of program design:** N/A
15. **Funding 1. - Available for free:** Yes
16. **Funding 2. - Types of funding:** N/A
17. **Target groups:** students, employees, professionals between jobs
18. **EQF level:** TBD
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job: Yes
    b. Does the program provide credits (ECTS): No

c. Is it modularized: Yes
d. Does it provide any certification per module: No

20. **Certification:** Certification of attendance

Business and operational model

1. **Relevance of program:** N/A
2. **Definition of targets:**
   a. Name the skills you target: N/A
   b. Enter their ESCO codes: N/A
   c. Name the occupations you target: N/A
   d. Enter their ESCO codes: N/A
   e. Name the tools and systems that you target: N/A
3. **Financial structures:** N/A
4. **Use of resources:** N/A
5. **Licenses for digital tools:** N/A
6. **Marketing and student recruiting procedures:** N/A
7. **Employer feedback:** N/A
8. **Alumni engagement:** N/A

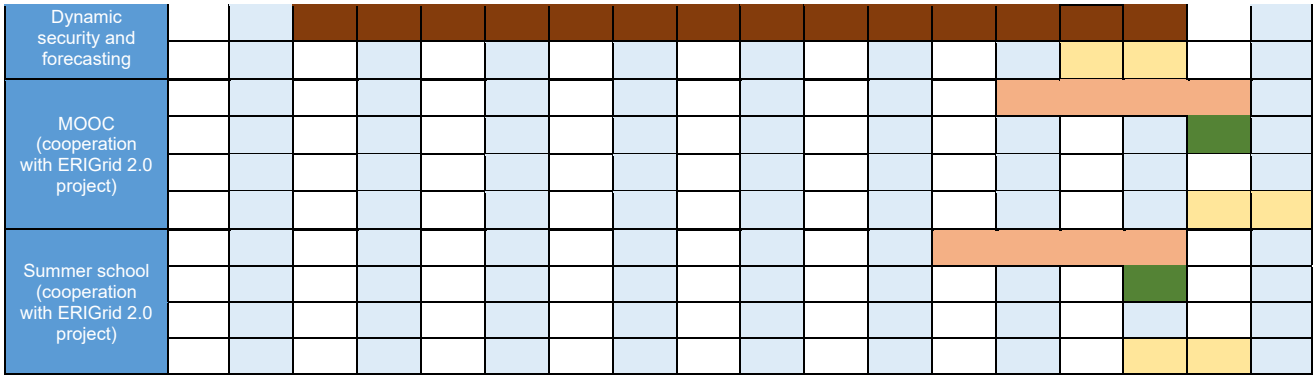
Learning and teaching model

1. **Admission requirements:** N/A
2. **Training goals:** N/A
   a. Training goal #1: Dissemination of the projects' goals and outcomes
   b. Training goal #2: Familiarize the participants with the training material of the project
3. **Program content - Syllabus elements in ICT/Digital:**
   a. **#1:** INFORMATION TECHNOLOGY - New trends in information technology
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
   a. **#1**: ELECTRICAL ENGINEERING - electrical engineering
5. **Program content - Syllabus elements in Energy:**
   a. **#1:** ELECTRICAL ENGINEERING - electrical engineering
6. **Program content - Syllabus elements in transversal skills**: N/A
7. **Program content – Re-use of training modules:** N/A
8. **Program contents – Intellectual Property Rights:** All contents are protected by copyright.
9. **Methodologies:** N/A
10. **Teaching methods:** N/A
11. **Evaluation methods:** N/A
12. **Internships:** N/A
13. **Scheduling:** N/A

3.2.3. Timeline of activities

Table 10 Timeline of activities provided by NTUA

Activity	Month																	
	03/22	04/22	05/22	06/22	07/22	08/22	09/22	10/22	11/22	12/22	01/23	02/23	03/23	04/23	05/23	06/23	07/23	08/23
Lectures on Local energy markets, energy communities and blockchain applications																		
Lectures on AI applications on energy systems:																		



	design
	analysis
	implementation
	assessment

3.3. Field test Milano

3.3.1. Overview of activities

Table 11 Overview of activities at Polimi

Target group	EQF Level	Timeline (from)	Activity	Main stakeholders	Part/s of Blueprint Strategy tested	Results delivered to EC	Energy (or other technological) sector	Contents
Professionals	7	August '22	**Design, production and implementation of a MOOC**	Politecnico di Milano Departments,	Training program marketplace. (MOOC: reduction of skill gaps, drafting of best practices, development of general templates)	Job profile addressed: Energy Manager Skills covered: Define the energy profile of buildings, Analyze energy consumption, Identify energy needs, Conduct energy audit, Advise on heating systems energy efficiency, Promote environmental awareness	Digital Energy management for real estates	Video Lectures, quizzes, case studies, online exploration, peer discussion

3.3.2. Description of activities

3.3.2.1. MOOC on Energy management for real estates

This pilot action focuses on the design, development, delivery, and monitoring of massive open online courses (MOOC). The course, titled "Energy management for real estates - Fundamentals, methods and digital tools" delves into the figure of the energy manager and is targeted at all those professionals who revolve around energy management in the real estate field. The course will be delivered online, through the POK - Polimi Open Knowledge platform; it will be provided for free and open to all. In addition, the materials will be distributed under a Creative Commons License (CC-BY 4.0), to ensure the opportunity of reuse and remix.

Program fact sheet

1. **Name of program:** Energy management for real estates - Fundamentals, methods and digital tools
2. **Program format:** MOOC (Massive Open Online Course)
3. **Program language:** English
4. **Length of program:** 4 Weeks
5. **Student´s estimated effort in working hours:**12 hours
6. **Industrial challenges addressed 1. – Economic and organizational:** None
7. **Industrial challenges addressed 2. – Social:** None
8. **Industrial challenges addressed 3. – Technical and regulatory:** Lack of adequate skills from employees; Technology integration (compatibility with existing processes/ technologies)
9. **Industrial challenges addressed 4. – Energy system:** Customers: Dedicated information about their energy profile
10. **Industrial challenges addressed 5. – Extreme situations:** None
11. **Industrial challenges addressed 6. – Other:** N/A
12. **Skill gap area:** Data management and analysis; Big Data; Cybersecurity; Programming and development competences
13. **ISCED code of program content:** 07 Engineering, manufacturing and construction
14. **Starting point of program design:** Energy program with an ICT add-on
15. **Funding 1. - Available for free:** yes
16. **Funding 2. - Types of funding**

17. **Target groups:** Professionals
18. **EQF level:**7
19. **Lifelong learning and certification:**
    a. **Is it possible to combine the program with a job?** Yes. It is specifically dedicated to Energy manager
    b. **Does the program provide credits (ECTS)?** No
    c. **Is it modularized?** No
    d. **Does it provide any certification per module?** No
20. **Certification:** Certificate of accomplishment

Business and operational model

1. **Relevance of program:**
    a. Promoting the empowerment of students to use their subject-specific knowledge in a broader context to tackle global and societal challenges and thus to solve problems with responsibility.
    b. Offering a learning path that addresses specific educative gaps in energy sector
    c. Promoting and disseminating knowledge coming from public universities to a larger public
2. **Definition of targets:**
    a. **Name the skills you target:** N/A
    b. **Enter their ESCO codes:** N/A
    c. **Name the occupations you target:** Energy manager
    d. **Enter their ESCO codes:** 1349.12
    e. **Name the tools and systems that you target:**
3. **Financial structures: The programme is included in university didactical activities**
4. **Use of resources:**
    a. **#1:** staff days to maintained the programme
    b. **#2:** Permanent and free accessibility of the programme in the future
5. **Licences for digital tools:** No
6. **Marketing and student recruiting procedures:**
    a. **#1:** University social network
    b. **#2:** Teachers connection
    c. **#3:** POLI TAM TAM
7. **Employer feedback:** N/A
8. **Alumni engagement:**
    a. **#1:** Politecnico di Milano Career office newsletter
    b. **#2:** METID social networks

Learning and teaching model

1. **Admission requirements:** no requirements
2. **Training goals:**
    a. **Training goal #1:** Understand and critically assess Energy Efficiency policies and the process and tools for estimating the energy savings potential of a building and implementing and verifying savings.
    a. **Training goal #2:** Categorize Energy consumption in a building, determine a strategy to evaluate Energy performance, and define and explain the multiple benefits of Energy Efficiency
    a. **Training goal #3:** Explain the barriers to investment in cost-effective Energy Efficiency and define and evaluate the tools that can overcome these barriers, with specific focus on digital based strategies.
    a. **Training goal #4:** To identify elements of digital transformation in the energy for building sector, challenges and solutions, and impact
    a. **Training goal #5:** Collect, manage and analyse data
3. **Program content - Syllabus elements in ICT/digital:**
    a. **#1:** CONTROL - Remote Control and Automation
    b. **#2:** CONTROL - Applications: electric drives & controllers
    c. **#3:** CONTROL - Advanced Control Techniques

   d. **#4:** CONTROL - Industrial automation, Industrial control (PLC, PID, etc.)
   e. **#6:** MODELLING, SIMULATION & OPTIMISATION - Modelling, simulation & optimisation
4. **Program content - Syllabus elements in another STEM than ICT/Digital:**
   a. **#1:** HEAT & COOLING ENGINEERING - Heat & cooling installations
   b. **#2:** BASIC MECHANICS - Thermal engines (heating and cooling)
   c. **#3:** BASIC MECHANICS - Heat transfer
   d. **#4:** ENERGY MANAGEMENT & GREEN SKILLS - Sustainable development
   e. **#5:** HEAT & COOLING ENGINEERING - Heat & cooling installations
5. **Program content - Syllabus elements in Energy**
   a. **#1:** MODELLING, SIMULATION & OPTIMISATION - Modelling, simulation & optimisation
   b. **#2:** CONSTRUCTION/INFRASTRUCTURE - Structures & construction
   c. **#3:** ENERGY MANAGEMENT & GREEN SKILLS - Energy Transition
   d. **#4:** ENERGY MANAGEMENT & GREEN SKILLS - Flexible demand and Smart home/buildings
6. **Program content - Syllabus elements in transversal skills**
   a. **#1:** MANAGEMENT & BUSINESS - Economic Analysis of electrical systems
   b. **#2:** MANAGEMENT & BUSINESS - Economy of Energy, Markets and Regulation
7. **Program content - Re-use of training modules**: Yes, by others Politecnico di Milano courses
8. **Program content - Intellectual Property Rights:** the course will be released under a Creative Commons licence. The experts are evaluating which one.
9. **Methodologies:** Worked examples - Magistral lecturing
10. **Teaching methods:** Magistral lectures - Personal study - Practical exercises
11. **Evaluation methods:** Other (please specify): quizzes
12. **Internships:** No
13. **Scheduling:** self-paced

Program Content

The program content for this pilot action was designed, with a team of Politecnico di Milano faculty, from the needs and skill gaps identified in the EDDIE project WP2. In particular, the program will focus on the figure of the Energy Manager in the real estate sector and will provide the necessary information to:

- verify consumption, through ad hoc audits or, if available, through digital models or reports produced by remote management;
- optimize consumption through the correct regulation of systems and their appropriate use from an energy point of view;
- promote energy-aware behavior by employees and/or occupants of the facility;
- propose improvement investments, possibly improving production processes or the performance of related services.

The course design, as well as the subsequent phases of this pilot activity, takes into account the drivers and objectives of the Blueprint Strategy: it will therefore cover part of the "green skills" or "sustainability skills" that are becoming increasingly in demand in the energy management sector. It will also provide "integrated" knowledge and train experts to understand issues that are traditionally outside their area of expertise. The MOOC will target real estate professionals, but will be open to anyone interested in the field.

PHASE 1 - MOOC design

During the design phase, the skill gaps to be covered were identified, and starting from these, POLIMI faculty defined the intended learning outcomes of the course. Then the structure of the course was set and the contents were outlined as follows:

Table 12 Structure of MOOC on Energy management for real estates

WEEK 1 (Introduction)	MOOC presentation (trailer)
	The energy manager profile and main skills/activities
WEEK 2	Structure of the energy sector at national and international level
	Energy Commodity Supply and Markets
	Heat transfer and energy balance of a building
	Sun, light and glazing
	Building technical systems
	Weekly Quiz
WEEK 3	Energy audit
	Energy efficiency of the building envelope
	Energy efficiency of the technical systems
	Renewable energy sources
	Weekly Quiz
WEEK 4	Energy digital models and simulations
	Retrofit of existing buildings
	Weekly Quiz

PHASE 2 - MOOC implementation

Each of the contents listed in the index will correspond to a video lesson from the course. The videos have been designed through the use of a storyboard (draft images, inspiration images, and text) that creates an organized sequence of the information to be communicated.

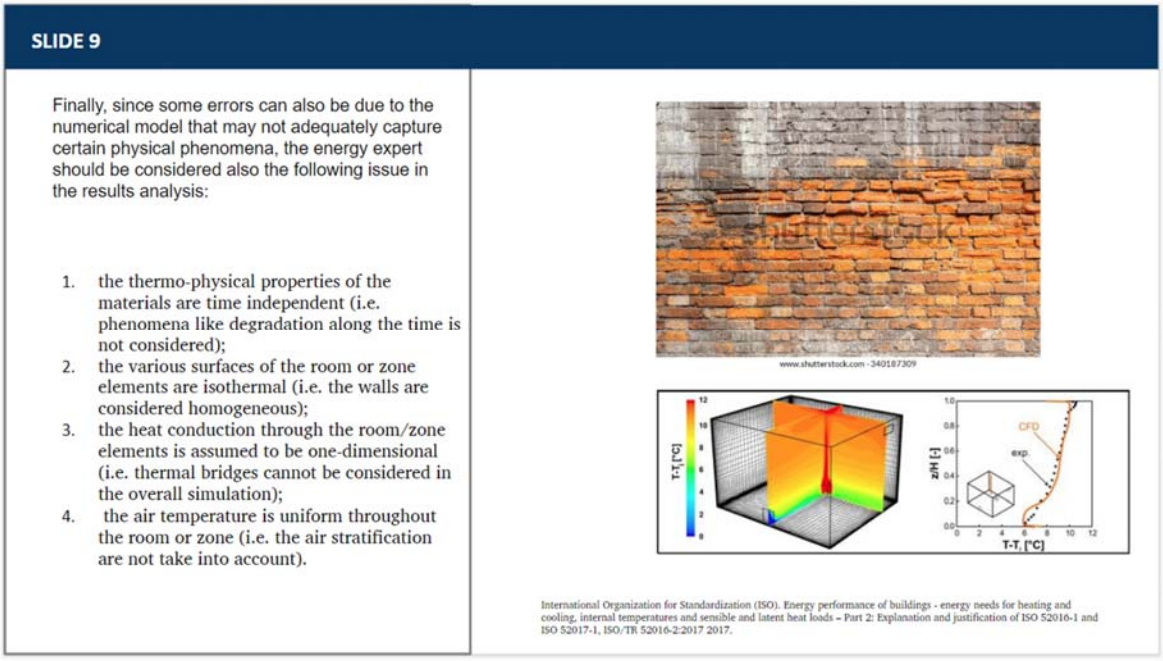


Figure 16 Extract from a Video-lesson storyboard

In the coming weeks, it will be finalized the recording of all video lectures. They will be filmed using the green-screen technique that will allow, in post-production, textual images and diagrams to be added alongside the lecturer's figure. The style of the graphic elements will be designed to facilitate understanding of the key content of the talk.

Figure 17 Pictures from POLIMI recording studio

All videos produced will be uploaded, along with the quizzes and textual content, in the MOOC platform. After a careful debugging phase, the course will be opened and will be available for free within the POK - Polimi Open Knowledge platform.

PHASE 3 - MOOC assessment

POLIMI will monitor enrolments, participation and forum exchanges among peers in the forum.

Once launched, the course will be monitored by tutors checking activities, messages, offering support to participants. A specific monitoring plan to collect feedback and evaluate pilot through questionnaires will be designed and implemented.

The pilot evaluation process will be conducted in the following steps:

- an initial questionnaire will be published in the course description of the MOOC on POK platform. The course description will give detailed information about the course, such as duration of the course, effort required, starting and ending date, learning structure, assessment, pre-requisite, lecturer, etc. This questionnaire aims at collecting main personal data from enrolled people and better understand their expectations
- a final questionnaire will be sent to all people enrolled to collect information about their experience: are their expectation been satisfied? How they rate the experience, contents and activities?

All data will be collected and analysed, and a final report will be developed.

3.3.3. Timeline of activities

The following timeline is on schedule with those already presented in the previous deliverable “D6.1 - Detailed development plan for the field tests”. The benchmarking and design phases were completed in October, while the other activities are proceeding as planned.

Table 13 Timeline of activities provided by Polimi

Activity	Month																	
	08/22	09/22	10/22	11/22	12/22	01/23	02/23	03/23	04/23	05/23	06/23	07/23	08/23	09/23	10/23	10/22	11/23	12/23
Benchmarking																		
MOOC design																		
Video Storyboarding																		
Video Recording																		
Video post-production																		
Texts, quizzes production																		
Implementation on the online platform																		
Debug																		
Launch																		
Monitoring and feedback																		

	design
	analysis
	implementation
	assessment

3.4. Field test Madrid

The aim of this training is to establish a complementary training module to the educational offer in Vocational Education Training (VET) at ESCUELAS PROFESIONALES PADRE PIQUER, which explicitly includes the possible restructuring of the electrical installation of a home, and the use of automation to improve energy efficiency and manage the energy consumption. The knowledge acquired can be applied throughout the national territory as it is based on the state regulations for the electrification of housing, and the training, as well as the model can be exported to any member country of the European Union.

Within the EDDIE Blueprint, this pilot specifically addresses VET education (EQF 4 & 5), and in particular the adoption of new technologies in the context of domotic systems and smart homes, building new skills for electrical installers, aiming at the digitalization of energy systems, starting with the consumers (and their installations), as the center target that has to drive this transition, and setting the grounds towards transforming their households to more advance functionalities.

3.4.1. Overview of activities

Table 14: Overview of activities at PIQUER

Target group	EQF Level	Timeline (from)	Activity	Main stakeholders	Part/s of Blueprint Strategy tested	Results delivered to EC	Energy (or other technological) sector	Contents
Students, employee and /or professionals	4, 5	Mar '23	**Home Energy Efficiency and Electrical Installations**	Piquer	Best practices, levers to reduce skills gaps, general templates	Teaching/learning material on electrical installations for smart homes	Power, IT	VET course for electrical installators

3.4.2. Description of activities

3.4.2.1. Home Energy Efficiency and Electrical Installations

This training develops a complementary training module to the VET offer of electrical technicians, addressing the restructuring of the electrical installation of a home, the application of energy efficiency measures, and the adoption of energy management. The training aims to fill in the current gap in the official training of general electrical installers, as tend to be mainly based on domotic systems for reducing energy consumption in air conditioning and lighting equipment, leaving aside the possible adaptation of the installation of the dwelling to improve energy consumption, the use of smart devices for continuous monitoring and control, and the training in the use of applications to allow such smart operation by both the installer and the user.

Program fact sheet

1. **Name of program:** Home Energy Efficiency and Electrical Installations Course.
2. **Program format:** On campus / On-site
3. **Program language:** Spanish
4. **Length of program:** 1 week
5. **Student´s estimated effort in working hours:** 30 h.
6. **Industrial challenges addressed 1. – Economic and organizational:** N/A
7. **Industrial challenges addressed 2. – Social:** Acceptance of new technologies and Lack of citizen engagement
8. **Industrial challenges addressed 3. – Technical and regulatory:** Reliability and stability need for machine-to-machine communication/ Lack of adequate skills from employees
9. **Industrial challenges addressed 4. – Energy system:**

Customer: Remote services to customers.
Customers: Remote metering.

10. **Industrial challenges addressed 5. – Extreme situations:** NO
11. **Industrial challenges addressed 6. – Other:** Home automation
12. **Skill gap area:** Data management and analysis/ Programming and development competences
13. **ISCED code of program content:** 0714, 0619 and 0713
14. **Starting point of program design:** Both
15. **Funding 1. - Available for free:** NO
16. **Funding 2. - Types of funding:** Public funding
17. **Target groups:** students/employees and professionals
18. **EQF level:** 4
19. **Lifelong learning and certification:**
    a. Is it possible to combine the program with a job? YES
    b. Does the program provide credits (ECTS)? NO
    c. Is it modularized? YES
    d. Does it provide any certification per module? YES
20. **Certification:** Diploma

Business and operational model

1. **Relevance of program:**
    a. **#1:** Specific and short training for electrical installers.
    b. **#2:** Training aimed at improving the energy efficiency of households.
    c. **#3:** Telecommunications and computer applications for consumption management.
    d. **#4:** Introduction of home automation as a digital tool to reduce energy consumption.
2. **Definition of targets:**
    a. Name the skills you target: Electronics and automation
    b. Enter their ESCO codes: N/A
    c. Name the occupations you target: Domestic electrician
    d. Enter their ESCO codes: 7411.1.1.1Name the tools and systems that you target: Smart devices and appliances for demand response
3. **Financial structures:**
    a. **#1:** Public funds for the teaching activity.
    b. **#2:** School´s own funds for the equipment.
4. **Use of resources:**
    a. **#1:** Classroom / lab.
    b. **#2:** Computers.
    c. **#3:** Multimedia projector.
    d. **#4:** Air conditioning equipment.
    e. **#5:** Electrical and home automation equipment.
5. **Licenses for digital tools:** YES but will be free access
6. **Marketing and student recruiting procedures:**
    a. **#1:** Students that are already finishing their studies at our School.
    b. **#2:** Short-term course before going into an internship to finish their studies.
7. **Employer feedback:** N/A
8. **Alumni engagement:**
    a. **#1:** A survey will be conducted after the internship to find out if the contents of the course have been used.
    b. **#2:** After 2 years there will be a follow-up on how the employability of the students who have taken the course has improved.

Learning and teaching model

1. **Admission requirements:** High school diploma
2. **Training goals:**
    a. Training goal #1: Extend the training of the participants.
    b. Training goal #2: Specific training in Energy-Efficient Homes.
    c. Training goal #3: Specific training in "phantom energy use" generated by devices in standby.
3. **Program content - Syllabus elements in ICT/ Digital:**
    a. **#1:** COMMUNICATIONS, NETWORKS & BUSES – Remote monitoring
    b. **#2:** INFORMATION TECHNOLOGY – Intelligent Systems
    c. **#3:** INFORMATION TECHNOLOGY – Internet of Things
    d. **#4:** INFORMATION TECHNOLOGY – Technical communications
    e. **#5:** CONTROL – Remote control and Automation
    f. **#6:** MOBILE APP DEVELOPMENT – Usability & User Interface
    g. **#7:** MOBILE APP DEVELOPMENT – IOS and Android Operating Systems.
4. **Program content - Syllabus elements in another STEM than ICT/Digital:/**
5. **Program content - Syllabus elements in Energy:**
    a. **#1:** ENERGY MANAGEMENT & GREEN SKILLS – Flexible demand and Smart home / buildings
6. **Program content - Syllabus elements in transversal skills:**
    a. **#1:** TRANSVERSAL PROFESSIONAL SKILLS – Problems solving
    b. **#2:** TRANSVERSAL PROFESSIONAL SKILLS – Teamwork
7. **Program content - Re-use of training modules:** Yes, future envisioned.
8. **Program content - Intellectual Property Rights:** Property of Piquer**.**
9. **Methodologies:** Practical learning, Problem-based learning, Interactive lecture, Scenario based learning
10. **Teaching methods:** Practical lab lessons, practical exercises, problem solving
11. **Evaluation methods:** Written examination, Projects
12. **Internships:** No
13. **Scheduling:** Full time

Program Content

As detailed next, the program consists of seven modules starting with the basics of the electrical installations in a house and the regulations, addressing the phantom or idle consumption, the applicable tariffs, the domotic systems, the generation technologies in buildings, the adaptation of the electrical installations, and the consumption management. Special attention is given to the domotic systems, the adaptations of the electrical installations, and the telecommunication and computer applications for energy management.

Module 1: Electrical installations in dwellings / Regulations (1.5h)

- Setting the bases and requisites necessary for the main objective of the course.

Module 2: Energy consumption of a dwelling (1.5h)

a) Study of the average consumption of a home, as well as the individual consumptions of typical equipment / devices.
b) Phantom or idle consumption.
c) Costs and tariffs applicable to the user of a dwelling.

Module 3: Domotic systems aimed at reducing energy consumption (4.5h)

- Basic competences in existing domotic systems needed to address the main objective of the course.

Module 4: Power generation systems in houses, and applicable regulations (3h).

Module 5: Adaptations of the electrical installations (4.5h)

- Possible adaptations and modifications to the electrical installation of a building with the aim of facilitating the monitoring and control by the installer and subsequently by the user, to improve energy efficiency and manage consumption.

Module 6: Phantom consumption (3h)

- Specific systems for reducing the standby consumption of devices normally connected in a house.

Module 7: Digitalisation of consumption (12h)

- Telecommunications and computer applications for consumption management.

3.4.3. Timeline of activities

Table 15 Timeline of activities provided by Scuelas Profesionales Padre Piquer

Activity	Month																			
	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23
Home Energy Efficiency and Electrical Installations Course																				

	design
	analysis
	implementation
	assessment

4. Relation of pilot activities to other work packages and to the blueprint strategy

EDDIE's purpose is to develop an industry-driven Blueprint Strategy for the Digitalization of Energy that will identify and try to cover the new skill needs in the European Energy Sector, emerging due to the digitalization of the sector. The roll-out of the BSDE will take place in the described pilot activities. The pilot activities' design is based on the different parts of the Blueprint Strategy, linking directly the WP6 roll out and action plan, to WP5 "BSDE development", and therefore to WP2 "Identification of current and future skill needs in the Energy Sector", WP3 "stakeholder mapping" as a database of various stakeholders related to energy sector and WP4 "best practices for VET, Universities and Lifelong Learning Programs (LLP)", that serve as inputs for the Blueprint Strategy definition and development.

The identified skill needs from the industry to tackle challenges related to digitalization, as described in WP2, as well as the skill gaps raised from the analysis conducted in the same WP, serve as inputs for the activities' content development. Most of the pilot activities include levers to mitigate at least one of the most significant skill gaps identified in WP2, namely, data management and analysis, big data, cybersecurity, and programming & development competences.

The connection of the education programs with the industry is analysed in WP3, aiming to map the relevant stakeholders from the various sectors of industry, education, administration and associations & communities, which is highly related to the pilot activities, allowing the pilot designers to define the educational content, based on the stakeholders' needs and also facilitate reaching out to the relevant stakeholders on each pilot activity.

The methodology, content, target groups and learning techniques are important for the success of the pilot activities. In this direction, the experiences of best practices in education, in the area of energy efficiency & transition, industrial transition & digitalization, as gathered and presented during WP4, provide valuable insights regarding the aforementioned issues.

All this effort is fed as input in WP5 for the definition and design of the Blueprint Strategy. The Blueprint strategy contains several parts that will be applied and tested during pilot activities' design, deployment, and assessment. During WP5, an analysis has been conducted aiming to define a common language to describe skills, skill gaps, training goals and programmes. This structure of syllabus elements covers different dimensions, attempting to stand as the "body of knowledge" of the digitalized-energy ecosystem. This common language is an important tool that can be used for the description of the contents of any training program. During this analysis, several trends in occupations related to the digital transformation of the energy sector were identified. The trends are being utilized in the design process of the pilot activities, targeting skills relating to these specific occupations. Moreover, the general templates developed and described in D5.2 facilitate the collection of data from the existing programs and evaluation of the necessary data to guide the design of new programs. In that direction, most of the pilot activities follow the structure of a general template produced by EDDIE. One of the services contained in the BSDE is the training programmes marketplace. This platform facilitates the training providers into reaching wider audience, promoting their material, and testing its resonance. Various pilot activities that contain suitable training material will be placed in the marketplace, developed in the context of EDDIE.

The deployment of the pilot activities will be followed by an assessment procedure, targeting to provide feedback and update the BSDE. Questionnaires to the participants, challenging the alignment of the activities with the Blueprint Strategy and testing their impact, are part of the assessment procedure to be performed, aiming to provide feedback to pilot activities content and structure.

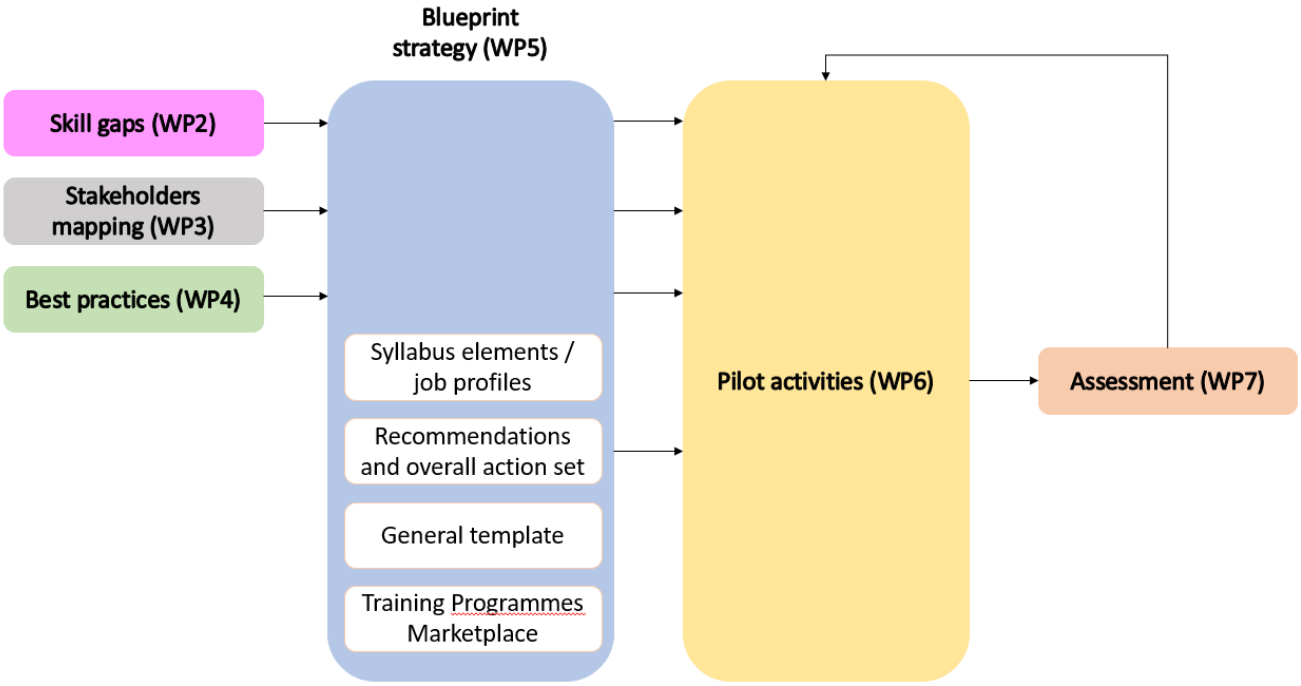


Figure 18 Relation of pilot activities to other WPs

5. Conclusion

EDDIE project aims to develop a Blueprint Strategy for the Digitalisation of Energy value chain (BSDE). This Blueprint will be industry-driven, considering the various technological, social and economic challenges created due to the digital transformation of the Energy Sector. New skills demand appears that needs to be covered in order to ensure the sustainability of the energy sector. Vital for reducing the new skills gaps are updated, modern training programs, that will enhance knowledge and expertise exchange among all involved stakeholders in a common way throughout European Union. Thus, the Blueprint Strategy focuses on the aforementioned issues, planning to establish a solid and sustainable framework to facilitate the continuous update of training programs offered in Europe, considering the current industry demand each time. Soft and green skills, social sciences, and humanities economics, as well as gender dimension will be taken under consideration in multidisciplinary approach, aiming to adjust to the rapidly evolving sector.

Tools and mechanisms of the Blueprint need to be tested and updated, ensuring the sustainability of the strategy, not only during the project, but mainly after its completion. Therefore, one central pilot in Germany (Aachen) and four smaller-scale pilots in Germany (Cologne), Greece (Athens), Italy (Milano) and Spain (Madrid) are developed. Activities for various EQF levels, are scheduled, including most of the parts of the Blueprint strategy, as presented in the table below.

Table 16 Parts of the BSDE tested in the piloting activities

Parts of BSDE tested	Aachen								Cologne			Athens				Milan	Madrid
	2.1.2.1	2.1.2.2	2.1.2.3	2.1.2.4	2.1.2.5	2.1.2.6	2.1.2.7	2.1.2.8	3.1.2.1	3.1.2.1	3.1.2.2	3.2.2.1	3.2.2.2	3.2.2.3	3.2.2.4	3.3.2.1	3.4.2.1
Levers to reduce skills gaps	✓	✓		✓	✓	✓		✓				✓	✓				✓
Levers to raise awareness and to reduce skills gaps			✓				✓										
Design of recommendation and overall action set	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓				
General templates	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓				✓
Best practices	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓				✓
Training programmes marketplace																✓	
Dissemination portal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

In this deliverable the content of each activity is described in-depth. Additionally, the program template as part of WP5 in the deliverables D5.2 and D5.3 is used to specify different parts of the piloting activities. This draws a direct relation to the WP5 and the Blueprint Strategy of EDDIE. However, other parts of WP5 are also linked to the piloting activities. Various pilot activities that contain suitable training material will be placed in the Marketplace platform of the BSDE, developed in the context of EDDIE. Also, the identified trends in occupations related to the digital transformation of the energy sector in WP5 are being utilized in the design process of the pilot activities, targeting skills relating to these specific occupations. Besides the described relation to the central WP5, there are further links to the other work packages of the project. So, for example, the content development of the piloting activities will be affiliated to skill needs and skill gaps identified in WP2. The stakeholder analysis of WP3 allows the pilot designers to define the educational content, based on the stakeholders' needs and reach out to the relevant stakeholders of each pilot activity. Lastly, the experiences of best practices in education, in the area of energy efficiency & transition, industrial transition & digitalization, as gathered in WP4 provide valuable insights regarding methodology, content, target groups and learning techniques.

In the attempt to reach greater participation, the planned actions cover different EQF levels and include interactions with local communities and young citizens, courses in universities, MOOCs, participation in summer schools and

lectures in academies, as well as between lectures & simulations & project-based programs. Some of the actions will take place in the context of synergies, expanding the dissemination of the project goals.

The activities will be followed by an assessment procedure presented in D6.1, aiming to provide feedback and update the Blueprint. The assessment will include both quantitative and qualitative indicators and targeted questionnaires to participants, in an endeavour to identify the impact of the activities and the alignment with the Blueprint strategy. One of the principal goals of EDDIE is to design a procedure where the Blueprint Strategy will be sufficiently and continuously tested and updated, based on the outcomes of the actions and the current skills needs of the industry sector. The successful design and implementation of this procedure will be vital for the sustainability of the BSDE.