



Education for Digitalization of Energy

Deliverable 6.1

Detailed development plan for the field tests

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Abstract:

This report aims to provide all the details of the development plan for the field tests in Aachen and smaller demo regions. The report will not only define the specifications of the actions designed and implemented in the field tests but will also describe the tools and measures that will be used to identify their impact and their coherence with the Blueprint Strategy for the Digitalization of Energy BSDE.

Keywords:

D6.1 Blueprint Strategy, Pilot, Aachen, development plan, assessment, KPIs

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Definitions, Acronyms and Abbreviations

ESCO – European Skills, Competences, Qualifications and Occupations

EQF – European Qualifications Framework

BSDE – Blueprint Strategy for the Digitalization of Energy value chain

KPI – Key Performance Indicator

MOOC – Massive Open Online Courses

LEM – Local Energy Market

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Executive Summary

The digitalization process of the Energy Sector creates not only several crucial challenges, but also great opportunities towards energy efficiency and sustainability. Personnel with the adequate skills will be required to take advantage of these opportunities. EDDIE's purpose is to develop an industry-driven Blueprint Strategy that will identify and try to cover the skills demand in the European Energy Sector digitalization.

The project aims to create new profiles of engineers, researchers and technicians, trained in -and familiar with- the new technologies, tools and methods to support and improve the digitalization of the Energy Sector. Additionally, the educational and research sectors should fit in the new era and be in the spotlight of synergies with industry, policy makers and other relevant actors.

The roll-out of the Blueprint Strategy for the Digitalization of Energy (hereinafter the BSDE, the Blueprint, or "the Strategy") will take place in a main pilot site in Aachen (Germany) and three smaller-scale pilot sites in Cologne (Germany), Athens (Greece) and Milan (Italy). This deliverable focuses on the description of these activities, including EQF-level targets, parts of the Strategy that will be tested, and possible results delivered to the EC. Additional tests may be incorporated during the rest of the EDDIE project, due to their potential interest. If so, this deliverable will be updated accordingly.

The central pilot in Aachen proposes diverse actions that will include learners from several EQF levels. As the leader of the pilot is RWTH Aachen University, some of the actions focus on the Education Sector, starting from lectures to secondary education (German Gymnasiums) and ending to actions for university students, Ph.D. and researchers. These activities will include lectures and workshops about modern power systems & digitalization as well as the dissemination of EDDIE project's material and Blueprint in an educational platform, targeting MSc students of "Power System dynamics" programs.

Aiming to raise synergies, and to appeal to a larger audience, the central pilot in Aachen also plans workshops and experimental demonstrations in cooperation with the local community, targeting to raise young generation's awareness about renewable energy and Digitalization. In the same direction, stands the partnership with Stadt Herne (City of Herne) to propose lectures and workshops, based on Smart-City initiatives, in order to achieve dissemination of the EDDIE scope to a wider audience. The aforementioned initiatives will be complemented by an interdisciplinary set of seminars addressed to German professionals, focusing on energy applications.

In coordination with the Aachen pilot site and in the context of the BSDE directions, smaller-scale pilot sites will be developed in Cologne, Athens, and Milan. The Cologne pilot site will be mainly industry-driven. It will include a program of the EWI Academy that will offer the companies the opportunity to train their employees on new trends in the Energy Sector. It will also include a certificate program for mastering the energy landscape of the future, addressing mid-senior employees, and a course to connect companies, training entities and students/employees, administrated by EWI Academy, aiming to reduce skills gaps in the Energy Sector. The Athens pilot site focuses on lectures and courses for university students in the field of new tools and mechanisms that will play a crucial role in the digitalization of the energy system. To raise synergies, NTUA also plans to participate in a summer school and a MOOC (Massive Open Online Course), 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 Milan, Italy, Politecnico di Milano will develop a MOOC on digital energy management for real estate, aiming to match green skills with the real estate sector.

The implementation of the activities will be followed by an assessment procedure to measure their impact. The assessment goal is to achieve a continuous update of the Strategy, seeking its sustainability after the end of the project. The assessment procedure for the tools and measures of the BSDE and the pilot activities are described, along with the preliminary KPIs.

Overall, several of the components of the Strategy are going to be tested through the pilots, assessing the possible impact they may have on the transition to the digital era of the energy system. Skill gaps that have been identified will be used as a starting point to develop training contents. The proposed templates for training programmes and the best-practice analyses will be utilized in the development process, while using the common language of "syllabus elements" that is being identified in WP5. The programs designed in the pilots will be distributed and disseminated through the "training-programmes marketplace" and the "dissemination portal" proposed by the BSDE.

1. Introduction

The Digitalization process refers to a complex system of economic and social activities. European initiatives related to climate change, as today expressed through the European Green Deal (nowadays being accelerated by FITfor55 and REPowerEurope), sets the European Union in the leading role in this challenge. The Energy Sector is a vital part in this transition towards a sustainable future.

Europe has a unique opportunity to establish a 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 framework enables and supports increasing shares of renewables, energy storage and demand response management, all of which can enhance 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 Digitalization. This Blueprint is an industry-driven strategy that will meet and anticipate the skills' demands for the sustainable growth and Digitalization for the European Energy sector.** The ongoing digitalization process of the Energy Sector raises major technological, economic and social challenges, creating new skills demands to be met in order to ensure the sustainable future of the Energy Sector. Providing adequate training, and fostering cooperation among all stakeholders harmonised throughout Europe, are vital activities towards that direction. The Blueprint strategy will establish a sustainable framework that allows to define and update educational programmes responding to industry changes, and to increase the attractiveness of the Energy Sector as a career choice. It will take into consideration green and soft skills in an interdisciplinary way, social sciences, humanities, economics, and gender dimensions.

All the efforts devoted to WP2, WP4 and WP5, identifying the skills gaps in the Energy Sector and designing Best Practice and BSDE, will be the bases for the design of the pilot demonstration activities. The main target in WP6 is the roll-out of the Strategy by pilot experiences. Identifying and categorizing skill gaps and the corresponding job profiles is of high importance to determine the appropriate contents and activities of the pilot sites. The pilot's contents and activities will also consider the best practices identified in WP4. The scope of this deliverable is the detailed planning of the pilot activities.

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), and Italy (Milano). The educational hubs, that will be created in WP3, will also play a role by monitoring the activities and providing feedback. The outputs and conclusions will provide feedback for the update of the Strategy, ensuring its sustainability, both during the project and after its completion, fostering the long-term and large-scale replication and continuous updating of training programmes. Other tests may be incorporated during the rest of the EDDIE project, due to their potential interest. If so, this deliverable will be updated accordingly.

Additionally, the report defines preliminary measures (questionnaires, specific KPIs) to identify the impact of the proposed and implemented actions and their coherence with the Blueprint Strategy for the Digitalization of Energy (BSDE). This will be an iterative process creating a feedback loop between the pilot activities and the overall Strategy.

The structure of the rest of this document consists of four chapters. Chapter 2 presents the activities that will take place in the central pilot in Aachen, followed by a detailed analysis of every activity, and the overall planned schedule represented as a Gantt chart. Chapter 3 presents the smaller-scale pilot sites in Germany (Cologne), Greece (Athens), and Italy (Milano), following the same representation style of the Aachen field test. Chapter 4 deals with the tools and measures that will be used for the assessment of the pilot activities, including questionnaires and KPIs, in order to ensure the long-term sustainability. Finally, Chapter 5 gathers the conclusions of the document, including the relations of the pilots with the overall EDDIE strategy.

2. Development plan for the field test Aachen

The design and implementation of the Aachen pilot are being tailored to the needs of education/training providers, the industry, and 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 do 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 -or aspects- of the BSDE value chain.

The Aachen pilot foresees the collaboration of RWTH Aachen University with the municipalities of Aachen (Stadt Aachen, <https://www.aachen.de/>) and of Herne (Stadt Herne, <https://www.herne.de/>).

Different piloting activities are going to be deployed and implemented: lectures, courses with supporting digital material, training programs addressed to professionals, workshops, and dissemination events. These activities will cover most (if not all) EQF levels, and will target all the identified strategic categories of stakeholders of the Energy and IT sectors (students, instructors, industry, local administration, and general public). This will allow creating a link between all the relevant actors of the “local energy community” and the BSDE.

2.1. Field test Aachen

2.1.1. Activities Overview Table

Table 1 List of activities for the Aachen pilot

WP6 - PILOT ACTIVITIES AACHEN								
Target group	EQF	From	Activity	Main stakeholders	Part/s of Blueprint Strategy tested	Results delivered to EC	Energy (or other technological) sector	Contents
Students (10-14 yrs old)	1, 2	June '22	Archimedischer Sandkasten	RWTH, Stadt Aachen	Lever to reduce skills gaps, Design of recommendations and overall action set, general templates, best practices	Teaching/learning material on renewable energy and Smart grid concepts - Computing tools and platforms, Use of Data analysis software (also open access)	Power, IT	A set of introductory lectures on topics related to smart grids, energy transition challenges and digitalization, supported by practical demonstrations. Tailored to kids of targeted schooling age.
High school students	2, 3	Oct '22	Gymnasium lectures	RWTH, High school teachers and students	Lever to reduce skills gaps, Design of recommendations and overall action set, general templates, best practices	Teaching/learning material on renewable energy and Smart grid concepts, Computing tools and platforms, Use of Data analysis	Power, IT	A set of introductory lectures on topics related to smart grids, energy transition challenges and digitalization, supported by

						software tools (also open access)		practical demonstrations. Tailored to high school students and teachers.
VET, industry, municipality, citizens	3 to 8	June '22	Partnership on IdeasForum and Smart People City	Stadt Herne and RWTH	Levers to raise awareness and to reduce skills gaps, Design of recommendations and overall action set, general templates, best practices	TBD	Power, IT, correlated sectors (TBD)	Lectures, workshops or mini-course for professionals - Dissemination events and material
Bachelor	6	Summer '23	Short course for RWTH Academy	RWTH International Academy	Levers to reduce skills 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	Lectures, workshops or mini-course
Bachelor and Master	6, 7	Oct '22	Leonardo lectures	RWTH	Levers to reduce skills 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	Lectures, workshops or mini-course
Master	7	Oct '22	International university exchange (Jupiter4Power project)	RWTH, Univ. of Comillas, Politecnico di Milano	Levers to reduce skills gaps, Design of recommendations and overall action set, general templates, best practices	E-learning platforms and material Computing and Data Analysis tools Use of Data analysis software tools Learning Outcomes, in terms of skills and knowledge, will be in line with ESCO and EQF framework	Power, IT	Lectures, workshops or mini-course
Municipalities, industry, trainers, learners, citizens)	3-8	Oct 22	Information event on digitalization in energy sector	RWTH, Fein e.V. (+ other student organizations like energybirds e.V.)	Levers to reduce skills gaps, Design of recommendations and overall action set, general templates, best practices	TBD	Different industrial sectors (TBD)	Lectures, workshops or mini-course for professionals - Dissemination events and material

2.1.2. Activities description

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. Piloting activities cover EQF levels from 1 to 8 (but with a higher focus on levels 3-8) and are directed to students (from secondary school level up to MSc level), researchers, professionals and other stakeholders from the industry sector, with the aim of bringing awareness, expertise and (re)skilling in the Energy Sector.

2.1.2.1. Stadt Aachen's Archimedischer Sandkasten event (EQF: 1-2)

Aiming to raise synergies, EDDIE plans to create partnerships with local municipality and schools organized through the Archimedischer Sandkasten (literally, "Archimedean Sandbox") initiative. The Archimedischer Sandkasten is a joint project of the City of Aachen and its universities RWTH, University of Applied Sciences (FH), Catholic University of Applied Sciences NRW (KatHO) and the University of Music and Dance under the umbrella of the "Future Lab Aachen". After starting in 2016, a sandpit is set up during the months of June of July of every year on the Katschhof in Aachen, in and around which the science city of Aachen offered many activities, especially for its young citizens, under the motto "Building the future".

RWTH and the other universities have been since then guests, and have rolled open workshops.

The participation in 2022 will see the ACS Institute of RWTH rolling two open workshops addressing aspects of renewable energy and digitalization. The workshops will include lectures and experimental demonstrations. Real time simulations supported by digital platforms and wind turbine models will be run to explain the audience how to set up and operate a wind-park, and how wind park operation affects the stability of the power system.

This piloting activity is aimed at raising interest and awareness around the young generation, on modern power systems engineering and energy transition topics.

2.1.2.2. Gymnasium lectures (EQF: 2-3)

The ACS Institute has collaborated for years with some high schools of the Aachen region, organizing lectures and workshops aimed at raising interest, awareness, and some basic knowledge on topics of modern power systems engineering.

Within the context of the EDDIE piloting activities, ACS will organize a small number of yearly lectures, run throughout the school season and starting from October '22. The topics will be agreed with the schools' managers and instructors.

The outcomes of the lectures will be evaluated through questionnaires at the end of the sessions.

2.1.2.3. Partnership with Stadt Herne on IdeasForum and Smart People City (EQF: 3-8)

Aiming to raise synergies, EDDIE plans to create partnerships with local administrations, industry and citizens. To this aim, the ACS Institute has set a collaboration with the city of Herne in the context of the "Smart People City" and the IdeasForum initiatives.

The city of Herne is part of the Ruhr Metropolis (North Rhine-Westphalia), which is the largest urban area in Germany and the third largest one in the European Union. It consists of 53 cities and more than 5.1 million residents, and offers, among others, huge opportunities for smart-city startups to scale with their innovative solutions in the region and in Germany as a whole. While the Ruhr Metropolis wants to become Germany's "smartest" region, also the city of Herne, with just over 150,000 inhabitants, is not short of ambition when it comes to digital transformation. Under its recently established digitization unit, the city is gearing up for future challenges posed by climate change and extreme weather events. Overseen by the Mayor's office, the digitalization unit is in charge of attracting a worldwide network of premium partners and startups from the digital economy to support the city's path towards becoming a Smart City, and consequently, part of the Smart Region of "Ruhr". Specifically, the city of Herne joined forces to see its strategy Herne 2025 being implemented. In order to give the development of the city a clear perspective, the city of Herne has created a vision of the future of Herne that can be summarized in three terms: urban, digital and international.

This mission statement is the basis of urban development that focuses equally on social, economic, and ecological aspects supporting resource and climate protection with the use of digital technologies. To implement these strategies, the city requires real-time data on temperature, rainfall, wind speed, and -for example- photovoltaic production, along with smart-grid data. The goal is to be able to produce forecasts for data-driven solutions in order to protect natural resources and consequently the climate, and solve future challenges by increasing the usage of e-Mobility. Furthermore, the utility company of the city has the target to protect shafts from leakage in times of flooding.

In this broad scenario, the ACS team will collaborate with the city of Herne to propose training, lectures, and workshops, as well as to participate and organize dissemination events. The partnership will kick-off at the end of June 2022, with the joint participation of representatives of the Herne municipality and the ACS team in a Digital Day where the aim and scope of the EDDIE project will be presented to a broad audience (citizens, local administration, and industry)

2.1.2.4. Summer School for RWTH Intl. Academy (EQF: 6-7)

The RWTH International Academy offers further education opportunities in the fields of production technology, engineering, materials, management, medicine & health, quality management, and robotics. In its Summer Schools, students attend short courses where they learn the fundamentals of advanced topics.

The Summer School organized by the ACS Institute features courses on Automation, Simulation, Cutting Edge (Digital) Technology, Big Data, Artificial Intelligence, and Industry 4.0. A topic-simulation phase of the summer school features various exercises in a computer lab, where students solve real-world problems by applying software and acquiring a solid understanding of methods used in engineering. Finally, during a lab tour, students can also gain an insight into the academic research approaches.

The summer school will be included in the piloting activities of the EDDIE project from Summer 2023, with short courses that will be designed and implemented specifically in line with the scope of the BSDE.

2.1.2.5. Leonardo lectures (EQF: 6-7)

Project "Leonardo" offers interdisciplinary teaching at the RWTH University. The courses are open to students from all faculties and are offered jointly by lecturers from different scientific cultures. In this way, students can get to know the different ways of thinking and approaches of various disciplines beyond the boundaries of the departments through joint, interdisciplinary work.

Each course focus on one specific social challenge. The Leonardo project is conceived as a building block of the concept "RWTH 2020 - Meeting Global Challenges". It is also a component of another future concept of the RWTH Aachen University, "Students at the Center of Excellence", which was founded in the "Excellent Teaching" competition.

Aiming to raise synergies, the ACS Institute will take part in this initiative, organizing lectures and workshops to Bachelor's and Master's students, on topics of power systems automation, advanced analytics for modern power systems, and digitalization.

2.1.2.6. International university online cooperation (Jupyter4Power project) (EQF: 7)

The continuous improvement of teaching and learning, through the use of didactically sound methods of blended learning, as well as strategic and complementary international cooperation, have high priority in the EDDIE concept of Best Practices and in the overall Strategy.

In order to support the initiation and expansion of strategic partnerships in teaching, RWTH participated in 2021 in the "International Cooperation Online (ICON)" competition, and it was awarded to run a successful project, Jupyter4Power, that delivers innovative approaches to foster collaboration between students at RWTH and partner universities, as well as English-language MOOCs.

The immediate target group of this project are Master's students of the "Power System Dynamics" course at Faculty 6 of the RWTH Aachen University, and the cooperating courses of Politecnico di Milano (PoliMi, Italy) and University of Comillas (Spain). We expect ca. 60 RWTH students, ca. 250 students at PoliMi in their courses "Electric power systems" and "Power Generation and Renewables", and a minimum of 20 master students per year at Comillas on Smart Grid (in cooperation with the Strathclyde University and MIT). In particular, Comillas envisions the activity for

the course “Control and Protection of Future Networks”. The Jupyter Notebooks developed in this project will be available for all universities taking part in the world-spanning eduGAIN federation (<https://edugain.org/>).

Given the amount of current dissemination activities, we expect to reach a large number of international students studying future power systems in the near to medium-term future. Opening the RWTHjupyter platform to eduGain institutions will enable future MOOCs to utilize the RWTHjupyter platform outside of the RWTH university

2.1.2.7. Information event on digitalization in the Energy Sector (EQF: 3-8)

In order to raise synergies and facilitate the creation of a sustainable network of strategic stakeholders, the ACS Institute will deploy and set a seminar and a dissemination event on Digital Energy. These activities can bring together professionals and researchers from Germany and from other countries, to learn and work on concepts and analytical techniques for next-generation energy systems. The events will have a multi-disciplinary focus, with talks about mathematics (optimization, stochastics, network theory, game theory and related areas), as well as computer science (artificial intelligence, machine learning, multi-agent systems, smart contracts, etc.), with a focus on energy applications, broadly defined.

The objective of this activity is to establish a forum for the research community, in Germany and beyond, that is interested in this topic; it will allow young researchers to showcase their own work, and also to enable networking and dissemination of the latest development in the field, from high-profile international speakers. Participation will be open to all relevant researchers who are interested to attend the events -- we especially encourage Ph.D. students and early-career researchers to join.

The seminar will be organized in Aachen in late 2022.

2.1.3. Activities schedule -Gantt chart

In the following chart, the “Design” procedure refers to the initial stage of the activity design (based on the identified skills gaps). “Analysis” refers to the adjustment of the designed activity (based on blocks & elements matrix, analysis of skills demands and general templates from WP5, and best practices from WP4). “Implementation” refers to the actual deployment of the activities. Finally, “Assessment” refers to the evaluation of the deployed activities (questionnaires and focus groups with students).





	Design
	Analysis
	Implementation
	Assessment

Table 2 Timeline for activities in the Aachen pilot

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		
Stadt Aachen Sandkasten event																				
Gymnasium lectures																				
Partnership on IDEASFORUM and Smart People City																				
Short course for Summer School of RWTH Academy																				
Leonardo lectures																				
Intl. university exchange (Jupyter4 Grid)																				
Information event on Energy digitalization																				

3. Development plan for other field tests

3.1. Field test Cologne

The piloting activities in Aachen are extended to a broader part of Germany and Europe, with additional pilots issued by the Institute of Energy Economics at the University of Cologne (EWI). The additional projects engages students, companies, and employees throughout Germany and Europe with different contents and addressees. The designed programs will align with the skills gaps identified in previous work packages and comprise various elements of the value chain of the Blueprint Strategy for the Digitalisation of the Energy (BSDE).

3.1.1. Activities Overview Table

Table 3 List of activities for the Cologne pilot

WP6 - PILOT ACTIVITIES Cologne								
Target group	EQF Level	Timeline (from)	Name of Activity	Involved stakeholders	Part/s of Blueprint Strategy tested	Results delivered to EC (e.g., skill gaps and needs covered, job profiles addressed, other technical/educational/industrial need)	Energy (or other technological) sector	Content of activity
Companies interested in trainings for own employees	4	Running	EWI Academy	EWI Companies affected by energy transition and markets	Levers to reduce skills gaps, Design of recommendations and overall action set, general templates, best practices	TBD with participating companies Focus on digitalization of energy sector: data analysis/platforms	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)

Professionals with min. 3 years postgraduate work experience	6	SS23	Certificate Programme Smart Energy – Mastering the Energy Landscape of the Future	EWI Professionals in energy	Levers to reduce skills gaps, Design of recommendations and overall action set, general templates, best practices	-Transforming the Energy Business -Smart Mobility -Smart Customer and Home -Smart City and Infrastructure	energy economics, business administration	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 students	5	WS22/23	Future Energy Certificate	EWI Students Companies	Levers to reduce skills gaps, Design of recommendations and overall action set, general templates, best practices	TBD together with participating companies	energy economics, business administration	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. Activities description

3.1.2.1. EWI Academy

Because of the transition of the European Energy Sector towards climate neutrality and due to the increasing energy prices, the importance of the input factor energy is expanding for many companies. Because of integrated energy, e.g., heat pumps and electric vehicles, the electricity sector affects new areas like heating and mobility. This development brings also to these areas aspects such as grid stability, decarbonization, and security of supply, since electricity is a commodity with unique characteristics. But there is more to energy than just electricity. New energy carriers, such as Hydrogen, will enter the energy sector on a larger scale, intertwining with existing ones and affecting both the supply and the demand sides.

Digitalization will be essential in orchestrating the interdependencies of different energy carriers and new demands. However, in an increasingly complex energy sector, the lifetime of knowledge is reducing, and updating knowledge is required more frequently in practice. Employees, both experts and practitioners, need new skills to cope with the unique challenges ahead. This circumstance is acknowledged by the EWI Academy.

The EWI Academy consists of training programs made of several modules on different contents, related to the digitalization-driven transition of the Energy Sector. The addressees of the EWI Academy companies, both on the supply- and demand-side, are willing to offer training to their employees on different carrier stages. The programs' modules are offered online and in-person, combining lectures with active parts, such as discussions. The modular

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 two-hour sessions. The training languages are German or English.

Programs:

- Energy Management Compact
- Crash Course Energy Scenarios
- Crash Course Hydrogen Economy
- Crash Course E-Mobility

3.1.2.2. Smart Energy Certificate Programme

The fast transition of the energy sector, combined with digitalization, 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 Smart Energy Certificate Programme "Mastering the Energy Landscape of the Future" addresses this circumstance.

The program consists of four modules, each one with a different focus, 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 individually, are spread over ten days within five months.

Modules:

- Transforming the Energy Business
- Smart Mobility
- Smart Customer and Home
- Smart City and Infrastructure
- Smart Energy Capstone Project

3.1.2.3. Future Energy Certificate

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 product that focuses on specific preconditions for working in the Energy Sector. It seeks to reduce the mismatch between the required qualifications in the Energy Sector and the ones of the applicants after graduating from university.

The program consists of several courses offered by collaborating companies. This approach ensures the practical relevance of the curriculum. Companies have an incentive to engage in teaching to position themselves as potential employers for the participants. By this approach, the beneficiaries of the program are both the students and the companies in the Energy Sector. The EWI is responsible for the administration, the communication between participants and companies, and the quality of the training 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 Points). Additionally, it consists of two projects organized by participating companies (60 Points).

Time Schedule for 1st year:

- July – September: advertisement of the program to companies
- September – October: advertisement of the program to master's students
- 1st November: Kick-Off
- November – April: Courses and 1st project
- 1st Mai: networking between companies and students
- Mai – September: Courses and 2nd project
- End of September: graduation of applicants

3.1.3. Activities schedule -Gant chart

	Design
	Analysis
	Implementation
	Assessment

Table 4 Timeline for activities in the Cologne pilot

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																			
Certificate Programme Smart Energy – Mastering the Energy Landscape of the Future																			
Future Energy Certificate																			

3.2. Field test Athens

To complement and enhance the pilot activities of the EDDIE project, a set of actions will take place in the National Technical University of Athens, in Greece, that will be integrated into the existing educational activities, yet they will incorporate the work of EDDIE. The process of designing and later implementing the pilot activities will be based on the skills gaps, as identified in D2.2, that are crucial for the digital transformation of the Energy Sector, as they are expressed by the industry needs, which were identified by EDDIE. Following the selection of the skills gaps to be addressed, the type and content of the activity will be designed, considering the implementation and testing of various elements of the value chain of the Blueprint Strategy for the Digitalisation of the Energy (BSDE).

3.2.1. Activities Overview Table

Table 5 List of activities for the Athens pilot

WP6 - PILOT ACTIVITIES GREECE								
Target group	EQF Level	Timeline (from)	Name of Activity	Involved stakeholders	Part/s of Blueprint Strategy tested	Results delivered to EC (e.g., skill gaps and needs covered, job profiles addressed, other technical/educational/industrial need)	Energy (or other technological) sector	Content of activity
Master's students	7	May '22	Course 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 minutes lectures on local energy markets and blockchain applications
Master's students	7	May '22	Course 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 minutes 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		Summer '23	Summer school (cooperation with ERIGrid 2.0 project)	NTUA, EDDIE, ERIGrid 2.0	TBD	TBD	Power	Presentations, educational material, workshops

3.2.2. Activities description

Smart RUE research unit of NTUA delivers courses in BSc and MSc levels and participates in various EU-funded programs. Therefore, pilot activities in Greece will focus on higher EQF levels (6,7). The core part of the piloting activities will orbit around the MSc program “Energy production and management”, aiming to update and upgrade existing content of the program, to reflect on the digital transformation of the energy sector. The MSc program attracts BSc graduates, researchers, and individuals from the industry sector, aiming to acquire expertise in the energy sector, upskilling or reskilling themselves, leading to bridging several skills gaps that appear in the industry. In this context, a dedicated course on the digitalization of the energy system has been recently introduced in the curriculum, which will be utilized by the EDDIE partner NTUA in the piloting activities, aiming at the same time to upgrade the content of the course. For this purpose, two lectures will be designed and delivered, using EDDIE’s outputs.

To complement these activities and to enhance the impact and outreach, a collaboration with the H2020 project “ERIGrid 2.0” will be established, utilizing available channels to test additional pilots. A MOOC, as well as a summer school will host some of EDDIE’s pilot activities.

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

To implement the activities described in 3.2, the Digital platforms, Blockchain, computing tools & platforms, mathematical optimization and data analysis have been identified skills gaps of high importance. Digital platforms, as well as computing tools & platforms are fundamental skills into the undergoing digital transformation, not only in energy sector, but in the whole industry. Strictly connected to this transformation is the data analysis skills, that the

industry is increasingly seeking for. Digital transformation and the rapid growth of digital platforms offer new opportunities in transactions and market forms. Considering these opportunities, mathematical optimization is a principal skill gap, along with Blockchain skill that, despite being a hot trend in the industry, has nearly no connection with educational programs of any level.

Skill gaps point to mismatches between educational providers and industry that EDDIE project aims to mitigate, based on the BSDE. A lecture that would try to cover some aspects of the aforementioned skills, including recommendations and overall action set, was deemed as an appropriate activity. The lecture to be designed and developed will contain additional examples and could serve as a general template for further updates.

The lecture will focus on Local Energy Markets (LEM) and the role of Blockchain technology in securing the decentralized coordination of distribution grids. Dividing the lecture into two parts, the main scope of the LEM part is to familiarize MSc students with the general structure of energy markets, smart grids, energy communities, and especially with local energy markets and peer-to-peer trading (digital platforms). In this part several examples of market models will be developed, accompanied by basic optimization and game theory principles used in market formulation (mathematical optimization). Crucial for a deeper understanding of the LEM operation would be a presentation of a simple simulation, pointing the transactions between the participants and their benefits from participating in the LEM (data analysis). The part dealing with Blockchain will aim to introduce students to basic cryptocurrency principles (Blockchain) and the link between decentralized energy markets and smart contracts. Respectively to the first part, a simulation is planned to be presented in order to demonstrate a cryptocurrency-based application in facilitating the operation of a LEM (computing tools and platforms).

An initial presentation of the lectures took place during the second semester of the MSc program in May '22. Further analysis and update of the lecture will be based on the results of WP5 and WP4. Inputs from the analysis and classification of syllabus elements which is taking place in WP5, and the skills demand analysis will be tested during the lecture. General templates that are being designed will be used, testing if they facilitate the development and presentation of the lectures. Inputs from WP4, regarding best practices, will be incorporated into the lecture implementation. The developed and updated lecture will be part of the training programs marketplace, expanding the course material to a larger audience. Also, the activities will be disseminated through the dissemination portal of the BSDE.

The lectures are planned to be presented in physical form during the spring semester of '23. The course, as part of the curriculum of the MSc program, will have a certification procedure, consisting of either final exams or project-based assessments.

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

Skills gaps that were identified during WP2 were selected to be tackled in this course: Artificial Intelligence, mathematical optimization, forecasting, data analysis, and machine learning. The increasingly high complexity of electric energy systems and the importance of dynamic security of transmission systems and distribution grids, in order to ensure stable and continuous power supply to all end customers, brings machine learning (decision trees) into the spotlight in the effort to improve dynamic security systems and algorithms efficiency. Mathematical optimization is a crucial factor in this improvement procedure. Furthermore, the rapid penetration of renewable energy resources in the energy system, inserts uncertainty into the electrical system, and therefore forecasting is necessary in order to maintain system stability. In forecasting, artificial intelligence and artificial neural networks appears as powerful tools for achieving accurate prediction of RES production in wide areas.

Skill gaps point to mismatches between educational providers and industry that need to be reduced according to BSDE. A course that would try to cover aspects of the latter skills, including recommendations and an overall action set, was promoted as a relevant activity. The designed lecture will contain additional examples and could serve as a general template for further updates.

The lecture will concentrate on machine learning in electrical systems' dynamic safety, as well as RES production forecast. Dividing the lectures into two parts, the main scope of the first part will be introductory to the subject, so that the students may get acquainted with basic machine learning and dynamic safety principles. For a thorough understanding of machine learning in dynamic safety assessment, artificial neural networks and decision trees will

be presented and analyzed: machine learning and mathematical optimization, followed by an appropriate example to compare different machine learning algorithms used for the dynamic safety of an electrical system (data analysis). Accordingly, the second part will briefly describe numerical power predictions, RES power predictions, and the connection between them (forecasting), as well as mathematical formulation forecasting and artificial neural networks examples (artificial intelligence). This part will also end with an example for evaluating the above-mentioned processes.

An initial presentation of the lectures took place during the second semester of the MSc program in May '22. The adjustment of the lecture, the BSDE parts tested and the presentation plan will follow the structure analyzed in 3.2.2.1

3.2.2.3. MOOC (cooperation with ERIGrid 2.0 project)

Aiming to raise synergies, EDDIE plans to participate in a MOOC, organized by the H2020 project ERIGrid 2.0 during the summer of '23. The MOOC will be open to students (BSc, MSc, PhD) and researchers, as well as to industry professionals and any other interested stakeholders. The MOOC will focus on “advanced validation methods for smart grids”. EDDIE is planning to develop and introductory lecture, highlighting the emerging needs for education, arising due to the digitization of the energy systems.

3.2.2.4. Summer school (cooperation with ERIGrid 2.0 project)

Similar to 3.2.2.3, EDDIE plans to participate in a summer school, organized by ERIGrid 2.0 during summer '23. The focus group intends to cover a wide area of EQF level and expertise. Summer school (3-4 days duration) will concentrate on smart grid applications, targeting to enhance the awareness of the participants about innovative tools and applications in the smart grid sector. The way that EDDIE will participate in the summer school (lecture, presentation) as well as the content to be developed and presented, will be determined in collaboration with the ERIGrid 2.0 partners and feedback from the EDDIE pilot partners, considering the outcomes of WP2, WP4, WP5. A primary target is to disseminate the EDDIE project's goals and tools through the training materials.

3.2.3. Activities schedule Gantt chart

The development process of the activities will have 4 stages. At first there will be an analysis phase, which refers to the analysis of the results produced by EDDIE, such as the identified skills gaps and the related job profiles, aiming to identify the content to be developed. After the analysis, there will be a design procedure where the activities will be designed and the contents will be developed based on the syllabus elements analysis of WP5, the analysis of skills demand and general templates developed in WP5, as well as best practices from WP4). The implementation phase refers to the actual deployment of the activities. Finally, the assessment will focus on the evaluation of the deployed activities (via questionnaires and focus groups with students), where the information will be gathered and fed back to the BSDE.





	Design
	Analysis
	Implementation
	Assessment

Table 6 Timeline for activities in the Athens pilot

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
Course on Local energy markets, energy communities and blockchain applications																		
Course on AI applications on energy systems: Dynamic security and forecasting																		
MOOC (cooperation with ERIGrid 2.0 project)																		
Summer school (cooperation with ERIGrid 2.0 project)																		

3.3. Field test Milano

The pilot will be designed and produced by METID, the Learning Innovation Task Force of the Politecnico di Milano. Since 2014, METID manages Polimi Open Knowledge (www.pok.polimi.it), a MOOC platform with more than 40,000 subscribers.

The interest in online courses and Massive Open Online Courses (MOOCs) has risen in the last few years, and it has been further increased within the social context of the Covid-19 pandemic. The MOOC platforms' benchmarking conducted in WP2 shows that the topics related to energy digitalization are not yet well defined, and that the skills and knowledge conveyed by the courses are rarely defined within reference frameworks (such as the EQF, ISCED...)

The Italian Pilot will be included within the Blueprint Strategy training program marketplace, and it will test the impact of an online training course (MOOC) focused on energy digitalization and consistent with the skill gaps identified by the EDDIE project. The MOOC produced will be positioned within the European reference framework, to support recognition of MOOC-based non-formal learning in the form of micro-credentials, as expressed in the *Proposal for a Council Recommendation on a European approach to micro-credentials for lifelong learning and employability* (2021).

3.3.1. Activities Overview Table

Table 7 List of activities for the Milano pilot

WP6 - PILOT ACTIVITIES METID - POLIMI								
Target group	EQF Level	Timeline (from)	Name of Activity	Involved stakeholders	Part/s of Blueprint Strategy tested	Results delivered to EC (e.g., skill gaps and needs covered, job profiles addressed, other technical/educational/industrial need)	Energy (or other technological) sector	Content of activity
Professionals	5 or 6	August 2022/End November 2023 with feedback collection and evaluation	<p>The pilot aims at testing the impact of online training, through MOOCs, on knowledge and competences on digital elements of professionals working in energy management for real estates.</p> <p>The pilot includes different activities:</p> <ul style="list-style-type: none"> - benchmarking on existing MOOC - design of our MOOC structure - video lessons and educational material design - content production - editing for online fruition - course development - course promotion and launch - monitoring of course and participants - feedback collection through questionnaires and interviews - evaluation of experience 	Chambers of commerce; Politecnico di Milano Departments; Company associations;	training programme marketplace	Computing tools and platforms, Use of Data analysis software tools Detailed skill gaps and Job profiles addressed → TBD	Tentative MOOC title: "Digital" Energy management for real estates	Lectures quizzes; case studies, online exploration peer discussion
General public (municipality, industry, trainers, learners, citizens)								

3.3.2. Activities description

After careful screening of the expertise in Politecnico di Milano's, it was possible to engage some faculty members interested in exploring the topic of energy digitalization in the real estate sector. This area is extremely interesting because it allows for the integration of topics related to the technological, architectural, and engineering fields within the same course. Thus, the MOOC will try to address one of the needs found through the WP2 analysis phase: to provide "integrated" knowledge and train experts capable of understanding events outside their bubble. In addition, the course intends to handle the topic of "Digital Energy management for real estate" by including part of those "Green skills" or "skills for sustainability" that are increasingly trending in the industry (see "*Deliverable 2.2 - Current and future skill needs in the energy sector*").

Activities will start in the summer of 2022 with a benchmarking phase to map existing MOOCs and online training on energy digitization for real estate. The course will be targeted at real-estate professionals, but it will be open to anyone interested in the field.

The benchmarking phase will be followed by a design phase in which the METID staff, according to the content experts, will define the table of contents of the MOOC and the exact skill gaps to be covered; the target audience will be also identified accurately in this phase. To increase transparency and interoperability of information in the European context, the MOOC will be described according to the following standards:

- Level: EQF (European Qualifications Framework),
- Subject Area: ISCED-F taxonomy (International Standard Classification of Education - Fields of education and training 2013) and
- Intended Learning Outcomes: [ESCO multilingual classification](#) (European Skills, Competences, and Occupations) - which also links skills to occupations.

Once the design is completed, the MOOC production phase will begin. Experts will work on content production: video lectures, quizzes, reflection activities, case studies, and additional resources. This phase will involve intensive teamwork among content experts, instructional designers, and visual designers, who will collaborate to deliver content for effective online fruition. This phase will also consider involving some stakeholders, who could contribute through interviews, case study insights, etc.

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

3.3.3. Activities schedule Gantt chart

Table 8 Timeline for activities in the Milano pilot

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	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									█	█	█	█	█	█	█			

4. Tools and measures for assessment and sustainability over time

For the sustainability of the EDDIE project's pilot activities, it is crucial to design a feedback mechanism that will help measure the impact of the proposed actions, as well as identify possible corrective actions. Once the first results of the pilot activities are measured, a post-analysis of the pilot projects will be conducted, extracting the main lessons learnt and feeding them back into the BSDE. This exercise will help define the methodology for the BSDE to adapt to changes and refine/change its recommendations.

The assessment process aims to analyse the sustainability of the strategy. The work in this stage is conceived as a multidisciplinary exercise, where technical-background profiles will meet social-background ones, and complement each other. A goal of the BSDE is to be useful to all the stakeholders in the Energy Sector and society, thus maximizing the likelihood that it is accepted, successful, and stable along time. The outcomes of this assessment will embody the research results of WP2, WP3, and WP4. This updating process will be continuous, incorporating the evolving changes in skills needs, targeting to update training contents. The ultimate goal is to shape the Strategy considering the different stakeholders' needs.

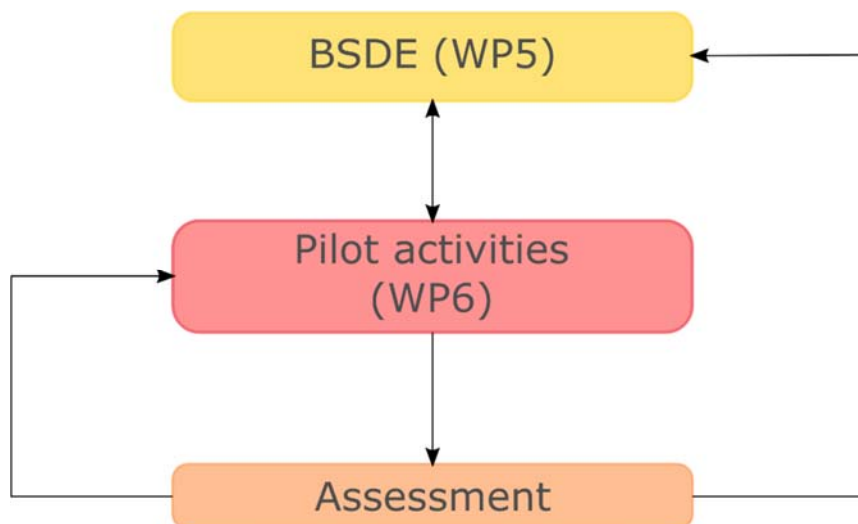


Figure 1 Assessment feedback mechanism

Activities are the first stage of “testing” the BSDE in a real environment, addressing students of diverse EQF levels, along with industry and institutional stakeholders. The implementation and analysis stage will be followed by the assessment stage, including dedicated questionnaires to both students and learners participating in the pilot activities and to participating stakeholders from the industry sector, as well as interviews with specific focus groups of students, teachers, administration officers, and industry professionals,. The surveys will aim at getting quantitative and qualitative information, to assess the tools and methods of the BSDE and the pilots. As a result of processing this information, the effect of the BSDE on reducing the skill gaps in different fields will be evaluated. This analysis will be used to improve the proposed methods and overall BSDE strategy, establishing an active feedback loop (in close collaboration with WP4 and WP5). The timeline for the assessment is presented in the timeline for each pilot activity in the previous sections.

The assessment will attempt to quantify some of the results, in order to measure the performance of the piloting process. Nevertheless, apart from the quantitative analysis, a qualitative one will also take place, aiming to assess the actual impact of the activities, which is hard to put into numbers. A set of preliminary indicators, both quantitative and qualitative, was set at WP8 and will be complemented during the design of the feedback mechanism. So far, the Key Performance Indicators presented in Table 9 are set, with an estimated benchmark value. The indicators, the process and the benchmarks will be revised during the piloting and assessment phases.

Table 9 Preliminary KPIs

KPIs	Quantitative indicators /Measurement procedure	Qualitative indicators	Reference Level
E-learning platform	Number of educational modules/tools/courses available online.	Analysis of feedback of the users	>=5 (including all, modules/tools/courses)
	Number of users.		>=100
Educational Material	Number of general educational material		>= 1 per tool/module/course
	Number of (offline/online) user manuals for the use of the e-platform	Analysis of feedback of the users	>=1 per component of e-platform
	Number of users.		>= 100
Number of “face-to-face” courses compared to the planning	Number of educational modules	Quality of the modules	>=9
Number of “face-to-face” participants	Number of users	Analysis of their profile	>= 40
Number of pilot activities	Number of pilot activities	Analysis of participation and engagement	>=5
Number of MOOC users	Number of MOOC users		>=100
Number of events and workshops organized	Number of events and workshops	Analysis of feedback from the participants	>=5

5. Conclusions

The EDDIE project aims to develop a Blueprint Strategy for the Digitalization of Energy value chain (BSDE). This Blueprint will be industry-driven, considering the various technological, social, and economic challenges due to the digital transformation of the Energy Sector. New skills demand appears, that need to be covered to ensure the sustainability of the Energy Sector. Vital for reducing the new skills gaps are updated, modern training programs, enhancing knowledge and expertise exchange among all involved stakeholders in a common way throughout European Union. 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 at any time. Soft and green skills, social sciences, economics, and humanities, as well as gender dimensions, will be taken under consideration in a multidisciplinary approach, aiming to adjust to the rapidly evolving sector.

Table 10 Testing of the BSDE elements in the pilot activities

Parts of BSDE tested	Aachen							Cologne	Athens				Milan		
	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		3.2.2.1	3.2.2.2	3.2.2.3	3.2.2.4		3.3.2	
Levers to reduce skills gaps	✓	✓		✓	✓	✓	✓		✓	✓	TBD	TBD	✓		
Levers to raise awareness and to reduce skills gaps			✓												✓
Design of recommendation and overall action set	✓	✓	✓	✓	✓	✓	✓		✓	✓					
General templates	✓	✓	✓	✓	✓	✓	✓		✓	✓					✓
Best practices	✓	✓	✓	✓	✓	✓	✓		✓	✓					✓
Training programmes marketplace				✓	✓	✓		✓		✓					✓
Research and dissemination portal									✓	✓					
Dissemination portal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

The concepts, tools, and mechanisms of the Blueprint need to be tested and updated, ensuring the sustainability of the Strategy after the completion of the project. Therefore, one central pilot in Aachen (Germany) and 3 smaller-scale pilots in Cologne (Germany), Athens (Greece), Milano (Italy), are developed. Activities for various EQF levels are scheduled, including most of the elements of the Blueprint strategy, as presented in the table above. The planned actions cover different EQF levels and include lectures to local communities and young citizens, courses in universities, MOOCs, participation in summer schools and lectures in universities, as well as a mix of lectures &

simulations & project-based programs, in the attempt to reach greater participation. Some of the actions will take place in hybrid environments, expanding the dissemination of the project goals. The activities will be followed by an assessment procedure, aiming to provide feedback and update the Blueprint. The assessment will include both quantitative and qualitative indicators, some based on targeted questionnaires to participants, in an endeavor 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 BSDE.