



Education for Digitalization of Energy

Deliverable 5.2

Intermediate draft templates for educational programs

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Abstract:

This deliverable consists of three main parts and one appendix. First, the process to develop the template is described, thereafter the actual template and the program characteristics included are described. Finally, an outlook to coming refinement of the template and program definition is presented. Appended to the deliverable is the data collected about ten existing training programs that has been used to validate the template.

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Definitions, Acronyms and Abbreviations

EC	European Commission
ESCO	European Skills, Competences, Qualifications and Occupations
EQF	European Qualifications Framework
EU	European Union
ICT	Information and Communication Technology
ISCED	International Standard Classification of Education
IT	Information Technology
VET	Vocational Education and Training

Executive Summary

The objective of this deliverable is to present the intermediate versions of the training program templates. In this template the parameters for characterisation and classification of educational programs to be analyzed, developed and offered within the EDDIE project are defined. The purpose of the templates is not only to present these parameters, the process of creating the template is equally important, since it consists of analyzing knowledge gaps, training offerings and existing programs thus involving an analysis of the current state of the practice. The intermediate status of the templates is to be interpreted as there is work remaining to further identify characteristics of future training programs – pilot and flagship programs to be developed in the EDDIE project. This final stage of the training template will be presented in D5.3.

The deliverable divides the training programs template into the three categories *Programs facts and goals*, *Business and operational model*, and *Learning and teaching model*. As can be seen, the template captures more information than is used to understand the content of a training program from a student's perspective – it also has information about the operational and logistical aspects of running the program. The *Programs facts and goals* is intended to provide quick data on the program useful for all audiences needing information about a program when making evaluation of training needs or similar. The *Business and operational model* is mostly relevant to training providers containing information about the setup of the program from an operational and business perspective. Finally, the *Learning and teaching model* presents detailed information about the programs content and structure, relevant for a teacher or student wanting to understand more about what the program offers.

A total of ten training programs have been surveyed to test the usefulness of the developed template. These programs are not to be seen as official EDDIE programs but are instead a relevant sampling of current offerings on the European training scene. The type and format of the program varies, which is intentional since they have been chosen to validate the template. The data gathered from these programs – although not forming part of the template itself - can be useful to learn more about present training offerings.

The report is concluded with a presentation of experiences gained from using the template. These experiences together with the further development of the template is presented in the final chapter of the deliverable.

1. Introduction

This deliverable D5.2 Intermediate draft templates for educational programs presents the process to develop the template as well as the data gathered to validated the usefulness of the template. The work is in an intermediate stage, as the work is planned to continue also during the coming year of the project in parallel to the development of the pilot and flagship training programs of the EDDIE project. The primary value of template as it is described in this deliverable is that it captures relevant information about educational programs that is needed for analysis of what programs offer in terms of covering knowledge gaps and what is needed in an operational and business perspective to deliver the program.

This first introductory chapter describes the process to develop the templates.

1.1. Structure of document

This deliverable consists of three main parts and one appendix. First in this introductory Chapter 1, the process to develop the template is described. Thereafter in Chapter 2, the actual template and the program characteristics included are described. Finally, in Chapter 3, an outlook to coming refinement of the template and program definition is presented. Appended to the deliverable is the data collected about ten existing training programs that has been used to validate the template.

1.2. Development of the template.

The work in the tasks has involved iterative development of documents and a web survey during a series of workshops – total of 6 workshops - starting in early June 2021, progressing during the fall and continuing into 2022. There has been active participation from all partners during the work and for each of the workshops the number of participants has been around 10 people. The participants of the workshops in both workstreams have been the same individuals, ensuring coordination. The workshops have all centred around "homework" prepared by the participants. The homework has for example been to present examples of novel programs at the partners or from elsewhere as well as presenting documentation describing programs – both formal and marketing related. During the later part of 2021 the workstreams have been merged into one focusing on gathering data from selected programs and populating a first database of existing and planned programs of fulfilling the selection criteria.

1.2.1. Workstreams

The rationale for separating the work into workstreams was to focus the discussions during workshops and meetings on the two related topics of *How to describe programs* and *Which types of programs to describe*.

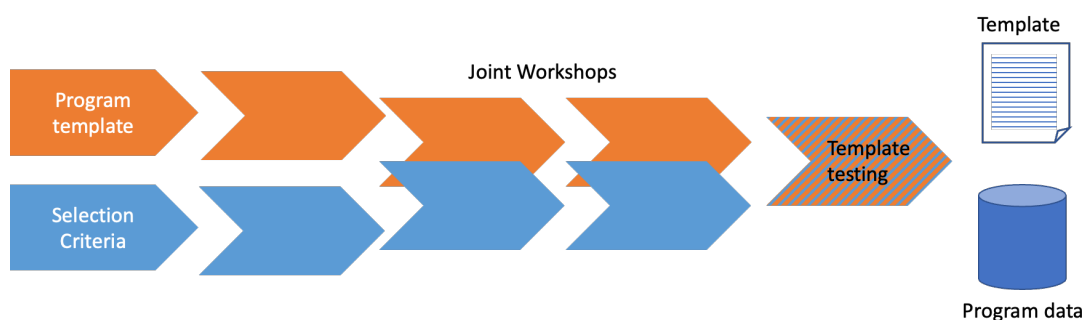


Figure 1 Overview of the workstreams in the development of the program template

Program template workstream

The focus of the program template workstream is to define the core information that is needed to describe a program including both topical content as well as operational and logistical aspects. This includes with regards to topic content for instance target group, objectives, teaching format, educational level etc. For operational and logistical aspects, it includes matters such as resources needs, online or on-site training, tuition fees, scheduling etc. The

main input to the work has been studies of programs available across partners and from other initiatives within Europe and internationally.

Program selection criteria workstream.

The focus of the Program selection criteria workstream has been to agree on which type of programs should be the target of the activities within EDDIE. Type here refers both to the format and educational level of the programs as well as to the topical content. The output from the work has been a taxonomy of relevant program dimensions, such as for example educational level, knowledge gap addressed, format and business model. These criteria were used during the later part of the work to identify which programs to use to test the viability of the template developed in the other work stream.

1.2.2. Output and results

The work has resulted in three outputs which will be described in this Deliverable D5.2 – Intermediate draft templates of educational programs. This includes:

- A listing of relevant program characteristics useful in selecting which programs are relevant to include in the work of EDDIE, both for analysis of existing programs as well as for development of new programs.
- A template for describing educational programs relevant to the EDDIE scope and goal, documented in a word document. Work is ongoing to document and better explain the included headings and concepts in the template.
- An online web-survey based on the template which facilitates the collection of data about existing programs and guide to which data is necessary in design of new programs.

2. Program template

This chapter presents the program template developed. The template is available both in terms of a word template – attached as Appendix B and also in the form of a web-survey available online, presently only to the project group, but access can be granted upon request.

2.1. Program fact sheet

The Program Fact Sheet is the first section of the template, which is designed to collect general information about the included programs. The program selection process and the initial statistics are based on this part.

2.1.1. Name of program

Registration of name of the program. The name does not have to be unique in the system. Free text entry.

2.1.2. Program category

Program categories are here limited to **existing** or **future envisioned** programs. This data point is relevant only within the scope of the EDDIE project. The data entry is based on selection of the two options presented. The categories are to be used for further use of the template also when designing programs, when this category allows searching of programs in development.

2.1.3. Flagship program

This data point is relevant only within the scope of the EDDIE project. The data entry is used to indicate which of existing programs, or programs under development should be defined as flagship programs within the EDDIE project. This data is a nomination from the project partner providing the data, and does not constitute a decision to denote the program as a flagship program. It is possible to mark the program as a flagship program covering major skill gaps by checking the option Yes.

2.1.4. Program format

This section describes the program format(s) offered to participants. Select all of the following options that apply: on-campus/ on-site; live virtual; online and blended.

2.1.5. Program language

This section shows the official language(s) of the program. Information is provided in free text.

2.1.6. Length of program

The duration of the program (in weeks, months, or years) and an estimation of the total amount of working hours that a student/participant needs to study in order to successfully complete the program.

2.1.7. Industrial challenges addressed

Highlight the industrial challenges addressed by the program. Selection of all options below that apply.

- Economic and Organizational - High economic costs
- Economic and Organizational - Business model adaptation
- Economic and Organizational – Funding
- Economic and Organizational - Low top management commitment
- Economic and Organizational - Goals/target-tracking
- Social - Privacy concerns
- Social - Loss of jobs due to automatic processes
- Social - Acceptance of new technologies
- Social - Lack of citizen engagement
- Technical and Regulatory - IT security issues
- Technical and Regulatory - Reliability and stability need for machine to machine communication
- Technical and Regulatory - Need to protect industrial know-how
- Technical and Regulatory - Lack of adequate skills from employees

- Technical and Regulatory - Data Management
- Technical and Regulatory - Data protection issues
- Technical and Regulatory - Technology integration (compatibility with existing processes/technologies)
- Technical and Regulatory - Lack of regulation standards and forms of certification
- Technical and Regulatory - Unclear legal issues
- Energy System - Customers: Remote services to customers
- Energy System - Customers: Dedicated information about their energy profiles
- Energy System - Customers: Remote fault announcement
- Energy System - Customers: Remote metering
- Energy System - Customers: Remote fault repairs
- Energy System - Network planning: Digital tools for network planning
- Energy System - Network planning: Geographical information systems
- Energy System - Network planning: Data for longer term load forecasting
- Energy System - Network planning: Load profiles
- Energy System - Network operation: Automation and fault clearance
- Energy System - Network operation: Remote switching
- Energy System - Network operation: Automatic fault indicators
- Energy System - Network operation: Crew management
- Energy System - Network operation: Online security assessment
- Energy System - Network operation: Short-term load forecasting
- Energy System - Maintenance and asset management: Predictive maintenance
- Energy System - Maintenance and asset management: Asset management
- Extreme situations (e.g. pandemic, extreme weather conditions)

2.1.8. Skill gap areas

Select which specific skill gap that the program addresses from the listed skill gap areas, Select all that apply. The main areas listed are the following: Data management and analysis; Big Data; Cybersecurity; Programming and development competences.

2.1.9. ISCED code of program content

The UNESCO has published a detailed list of disciplines with their corresponding International Standard Classification of Education (ISCED) codes. In this section the ISCED code(s) of the program is listed

2.1.10. Starting point of program design

Categorize of the program as an ICT program with an energy add-on, an energy program with ICT add-on or both by selecting one or both of the options. This is useful as a high level assessment of pre-requisites needed as well as emphasis of content in the program.

2.1.11. Program funding

This section gathers information about the funding of the program. The first, yes/no question, indicates if the program is available free of charge. In case the program is not free of charge to the student the following options can be selected: Public funding, Corporate funding, Individual funding.

2.1.12. Target groups

This section describes the target groups in terms of employment status. Select all the options that apply. The options are the following: Students (Pre-career stage); Employees (Mid-career stage); Professionals between jobs.

2.1.13. EQF level

This section provides information about the EQF level of the program. Choose a level from 4 to 7.

2.1.14. Lifelong learning and certification

This section describes the general plans for lifelong learning and the modularization of the program. Provided in the form of filling in free text boxes of the following questions:

- Is it possible to combine the program with a job?
- Does the program provide credits (ECTS)?
- Is the program modularized?
- Does it provide any certification per module? If yes, what type of certification?

2.1.15. Accreditation and certification

This section provides information about the form of accreditation and certification of the program. This is provided in the form of free text boxes.

2.2. Business and operational model

2.2.1. Program specification

2.2.1.1. Relevance of program

This section is used to explain the relevance of the program from a professional and technical point of view. Information is provided in a free text box.

2.2.1.2. Definition of targets

This section provides information about the targeted skills, occupations and tools/ systems with the help of ESCO codes if possible. Named and classified using ESCO codes by filling in the available free text boxes.

2.2.1.3. Partner profiles

This section presents the most important partners and their roles in the program. Partners are listed and described including their roles by filling in the available free text boxes.

2.2.2. Program design

2.2.2.1. Operations planning

This section explains in how the program is managed in terms of operations, including matters such as teacher allocation, booking of facilities and resources, learning management tools used etc. Information is provided in free text.

2.2.2.2. Financial structure

This section provides detailed information about program financing. Including your plans for e.g. sponsorship, subsidies/grants, tuition, and remuneration. Information is provided in free text.

2.2.2.3. Use of resources

This section describes the required resources and virtual/physical facilities for the program. Information is provided in free text.

2.2.2.4. Licenses for digital tools

This section lists the required licenses for digital tools used in the program. The data entry is based on an initial yes/no question, you can indicate whether there is a need to license any digital tools, and in the comments box, types of licence needed can be given.

2.2.2.5. Marketing and student recruiting procedures

This section describes your marketing strategy and plans for student recruitment. Information is provided in free text.

2.2.3. Implementation and success records

2.2.3.1. Certificates and certification methods

This section gives a detailed description of the certification methods and the certificates the program offers. Information is provided in free text.

2.2.3.2. Recruiting success

This section describes the recruitment targets in terms of the defined skill gaps and content. Information is provided in free text.

2.2.3.3. Financial success

This section describes the recruitment targets in terms of profit and sustainability. Information is provided in free text.



2.3. Learning and teaching model

2.3.1. Program design

2.3.1.1. Participant profiles

This section provides detailed information about the groups the program targets. Described in relation to ESCO classifications by filling in free text.

2.3.1.2. Admission requirements

This section describes the admission requirements of your program. This information is provided by selecting all the requirements that apply from the following options: No requirements, Bachelor degree, Master degree, Graduate, PhD, Other.

2.3.1.3. Training goals

This section gives a detailed description of your training goals. Information is provided in free text

2.3.1.4. Program content

This section provides a detailed description of the program content and information about eventual re-used training modules and IPRs. Information is provided in free text.

2.3.1.5. Teaching and evaluation methods

Teaching and evaluation methods are presented in this section. Information is provided in free text.

2.3.1.6. Use of digital tools

This section describes how digital tools contribute to the delivery of the program. Information is provided in free text.

2.3.1.7. Internships

This section indicates if the program includes internships or “on-the-job” training. Information is provided in free text.

2.3.1.8. Scheduling

The schedule of the program is presented here in general terms. E.g. intensive short course, extended semester, etc. Information is provided in free text.

2.3.1.9. Certification criteria

In this section the criteria for certification of students is given – what are requirements and what are percentages of success rates historically. Information is provided in free text.

2.3.2. Implementation and success records

2.3.2.1. Individual certification results

This section discusses the target results for individual certification. Information is provided in free text.

2.3.2.2. Program certification results

In this section discusses the intended targets for program certification are described. Which type of certification is aimed for in the program and how has it been achieved. Information is provided in free text.

2.3.2.3. Alumni engagement

This section discusses expectations and plans for alumni engagement, including experiences from using alumni in the development and operation of the program. Information is provided in free text.

2.3.2.4. Employer feedback

This section describes the types of feedback expected from employers and how this will be managed and used in analysis and development of the program. Information is provided in free text.

3. Experiences and next steps

This chapter presents the experiences gained when using the program template to gather information about the ten programs presented in Appendix A. These experiences together with additional tasks within WP5 as well as development of pilot programs in WP6 form the basis for next steps in the work. These next steps are presented at the end of this chapter.

3.1. Experiences

The survey has been tested by all the partners involved in the task. This section describes the main feedback gathered in terms of: The training programmes that each partner applied for the testing were agreed in advance in the selection criteria workstream (See Section 1.2.1), in order to guarantee a variety of possible cases. Each partner completed the survey independently, according to the timing and dynamics agreed within their organisation. The experiences are presented here as User Experiences with Survey and Organization and Clarity and finally Suggested points for improvement. Initially an overview of a typical method to test the template - here as implemented by project partner POLIMI – is given

3.1.1. Example of Template testing method

The following is an example of the testing procedure applied by POLIMI - METID:

STEP 1

POLIMI – METID, in agreement with the partnership, selected the MOOC series “**Introduction to artificial intelligence**” to be used as survey compilation test. The series is available on the Polimi Open Knowledge platform (<https://www.pok.polimi.it/>) and it consists of four MOOCs:

- MOOC1: Artificial Intelligence: An Overview
https://www.pok.polimi.it/courses/course-v1:Polimi+AI101+2021_M7/about
- MOOC2: Ethics of Artificial Intelligence
https://www.pok.polimi.it/courses/course-v1:Polimi+AI102+2021_M7/about
- MOOC3: Artificial Intelligence and legal issues
https://www.pok.polimi.it/courses/course-v1:Polimi+AI103+2021_M7/about
- MOOC4: Technologies and platforms for Artificial Intelligence
https://www.pok.polimi.it/courses/course-v1:Polimi+AI104+2021_M7/about

STEP 2

Two persons from POLIMI – METID staff, involved in the EDDIE Project, went through the survey without compiling it, but exchanging **feedbacks out loud**. Some notes have been taken.

STEP 3

The colleague who managed the production of the MOOC series, who is not involved in the EDDIE Project, was asked to **test the survey**. She was invited to fill in the survey by giving **comments out loud**. The two people involved in Step 2 observed and supported her when necessary.

STEP 4

The two staff members who led Step 2, went over the experience and **summarized the feedback**.

3.1.2. General User experience in answering the survey

The tests performed at POLIMI and also at the other project partners revealed some specific issues in terms of user experience:

The survey consists of many questions: a **lot of time** is needed to collect all the necessary information and to fill out the whole template.

Answering open questions requires considerable effort: the respondent has to be **properly motivated** in order to complete the task with commitment. (e.g. some suggestions to motivate respondents: marketing/promotion purposes, partner search/networking, support for better program design)

The information requested is wide-ranging: it often requires **more than one professional** to provide appropriate response.

The **purpose of the questionnaire is not clear**: the respondent struggles to clearly understand some questions and what level of detail the answer requires.

Questions containing ISCED and ESCO codes are complicated. In all cases where these codes have to be entered, it would be useful to add a **drop-down menu**.

Question 29 and Questions 39-41 are similar: they could be merged into one single question.

It might be useful to add a field asking for the **link to the program** (if it already exists).

3.1.3. Organization and clarity of the different sections

The following section lists specific feedback from respondents to be used in improvement of the templates in the coming work.

QUESTION 11 – Which ISCED code fits your program?

- Searching for codes is complicated: a drop-down menu could be introduced.
- A program can fit more than three ISCED codes: it would be useful to clarify the question. E.g. "Which are the three main ISCED codes your program fits in?".
- The entries *code* and *description* are not clear. It might help to clarify what is required in the *code* field and what is required in the *description* field. E.g.: "Enter only the numeric code in the *code* field and add the textual part of the ISCED code in the *description* field".

QUESTION 12 – What is the starting point in the design of your program?

- It might be useful to add two additional fields to the answer: "ICT program" and "Energy program".

QUESTION 21 – Definition of targets

- In some cases, it is difficult to identify the target group so precisely that all three fields (Skills, occupations, tools and systems) can be filled in. It could be stated in the assignment that it is required to fill in AT LEAST ONE of the three fields.

Question 22 – Partners profiles

- The program may have been designed and produced by a single organization, without the collaboration of further partners. The question could be modified to cover this possibility. E.g. "If you have no partners, please indicate this in the *comments* field".

QUESTION 23 - What are your plans for operations management?

- More than one respondent did not answer this question, indicating that he/she has not understood its meaning.

QUESTION 29 – Recruiting success

- One respondent did not answer this question because he/she did not understand its meaning. It might be useful to include a sample answer to clarify the question.

3.2. Next steps

The next steps of the work consist of mainly three topics. Refinement of template and survey, Coordination with work on Syllabus elements and support of implementation of flagship and pilot programs.

3.2.1. Refinement of template and survey

The overall idea of the template is to provide a consistent means of describing educational programs to be used in presentation of existing programs but also development of new programs. In this later stage the template provides

information to program developers on what kind of information is sought after from students, teachers and employers.

As the experiences presented in this section highlight, there is work remaining to refine the template to provide a good blend of ease of use and clarity while at the same time limiting the time needed to fill out the template – keeping in mind that during program design, the time spent is much more significant in the actual design, while documenting it is a smaller task.

Some suggestions to explore with regards to refinement of the template are to:

- Divide the survey in 3 different surveys: (“programs facts and goals”, “business and operational model”, “learning and teaching model”).
- Identify and clearly describe the main aim of the different surveys
- Identify and clearly describe the main target to fill in the different surveys

3.2.2. Coordination with work on Syllabus elements

In WP5 there is work ongoing to identify syllabus elements, which would form a key building block in definition of educational programs. To this point, the development of the template has not included such syllabus elements. A fruitful improvement of not only the template in itself, but also the design process is to evaluate the use of syllabus elements. Therefore, a promising next step is to investigate how these syllabus elements can be incorporated in the template and design and description of programs.

3.2.3. Support of implementation of flagship and pilot programs

A key deliverable of the EDDIE project is Pilot educational programs showcasing the Blueprint and capabilities of the project partners. These flagship programs can benefit from the structured process of developing the program template. An important next step is therefore continued coordination within the EDDIE project to provide the program template and survey as a design tool to be used in development of the Pilot program.

Annex A - Data gathered

This appendix presents, in raw form, the data gathered from project partners using the program template developed and presented in this appendix. The data is presented in a structure following the template. The data entered is to be seen as samples of relevant programs, it is not a set of official EDDIE programs.

A.1 Statistics on Program fact sheet

Programs included in the project

- **Master's in Smart Electrical Networks and Systems (SENSE)** – KTH Royal Institute of Technology, Electrical Engineering and Computer Science
- **Smart Distribution Grids** – Romanian Energy Center – CRE, Research and Innovation
- **Energy Technologies and Sustainable Design** – University of Cyprus, Electrical and Computer Engineering
- **Smart Energy - Mastering the Energy Landscape of the Future** - Energiewirtschaftliches Institut an der Universität zu Köln GmbH, Digital Energy
- **EWI Academy** – Institute of Energy Economics – EWI
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation)** – Comillas Pontifical University, Institute for Research in Technology, ICAI School of Engineering
- **MSc Energy Production and Management** - National Technical University of Athens (NTUA), Electrical and Computer Engineering
- **Executive Program in Infra Service Management** – KTH Executive School
- **Master's Degree in Smart Grids** - Institute for Research in Technology - Comillas Pontifical University, Smart and Sustainable Networks
- **Artificial Intelligence MOOC Series** - Politecnico di Milano, METID

Program Category

All ten programs are existing programs.

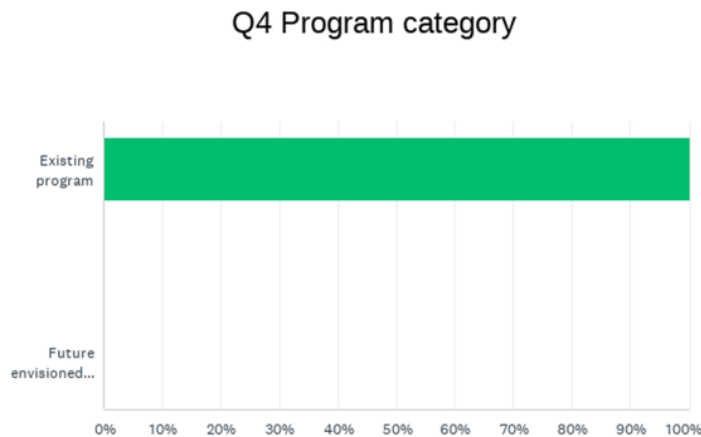


Figure 2 Program Category data

Number of flagship programs

Out of ten programs, there are six programs which are regarded as flagship programs.

Q5 Do you regard it as a flagship program?

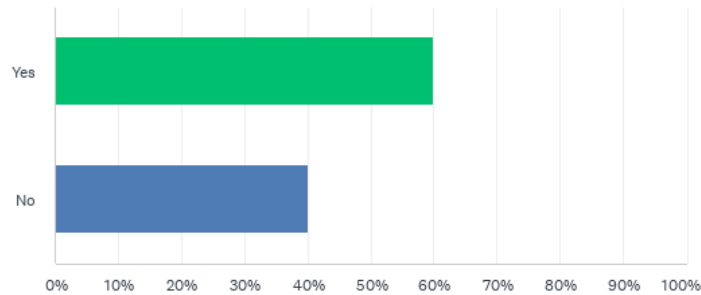


Figure 3 Program Flagship status data

Format

Out of ten programs, there are

- six on-campus/ on-site programs
- one live virtual program
- three online programs
- two blended programs

Q6 Format

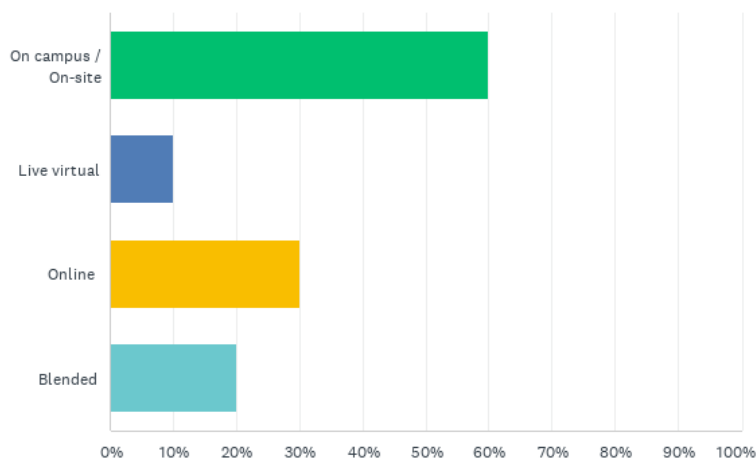


Figure 4 Program format data

Language

Out of ten programs, there are

- four English
- one English/Rumanian
- one English/Greek
- one English/German
- one Spanish
- one Greek
- one Swedish

Length of program

Please find information about the length of the programs below.

- **Master's in Smart Electrical Networks and Systems (SENSE)** – 2 years
- **Smart Distribution Grids** – 3 months
- **Energy Technologies and Sustainable Design** – 18 months
- **Smart Energy - Mastering the Energy Landscape of the Future** - 5 months
- **EWI Academy** – 2 months
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation)** – 6 months
- **MSc Energy Production and Management** - 3 semesters, 2 years maximum
- **Executive Program in Infra Service Management** - 4-5 months, 12 days in classroom
- **Master's Degree in Smart Grids** - 1 year. It can also be done in two years as part of a double master degree.
- **Artificial Intelligence MOOC Series** - 17 weeks (divided in around 4 weeks for each of the 4 MOOCs)

Student's estimated effort (total number of hours)

Please find the estimated number of hours needed in order to complete the program.

- **Master's in Smart Electrical Networks and Systems (SENSE)** – 5,040 hours (120 credits + autumn school, spring activities and a summer school)
- **Smart Distribution Grids** – 28 hours
- **Energy Technologies and Sustainable Design** – 91 ECTS X 25-30 hours
- **Smart Energy - Mastering the Energy Landscape of the Future** - 10 days for classes + several hours for a project work
- **EWI Academy** – Passive - Information Session for Corporate Graduate Programs
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation)** – 160 hours
- **MSc Energy Production and Management** - 5 hours per day
- **Executive Program in Infra Service Management** - 18 days
- **Master's Degree in Smart Grids** - 90 ECTS (2250 hours)
- **Artificial Intelligence MOOC Series** – 34 hours

The industry challenges the included programs address

- Economic and Organizational - High economic costs – 30%
- Economic and Organizational - Business model adaptation – 60%
- Economic and Organizational - Funding – 0%
- Economic and Organizational - Low top management commitment – 10%
- Economic and Organizational - Goals/target-tracking – 10%
- Social - Privacy concerns – 20%

- Social - Loss of jobs due to automatic processes – 10%
- Social - Acceptance of new technologies – 80%
- Social - Lack of citizen engagement – 10%
- Technical and Regulatory - IT security issues – 50%
- Technical and Regulatory - Reliability and stability need for machine to machine communication – 0%
- Technical and Regulatory - Need to protect industrial know-how – 0%
- Technical and Regulatory - Lack of adequate skills from employees – 40%
- Technical and Regulatory - Data Management – 80%
- Technical and Regulatory - Data protection issues – 30%
- Technical and Regulatory - Technology integration (compatibility with existing processes/technologies) – 70%
- Technical and Regulatory - Lack of regulation standards and forms of certification – 30%
- Technical and Regulatory - Unclear legal issues – 10%
- Energy System - Customers: Remote services to customers – 30%
- Energy System - Customers: Dedicated information about their energy profiles – 40%
- Energy System - Customers: Remote fault announcement – 10%
- Energy System - Customers: Remote metering – 30%
- Energy System - Customers: Remote fault repairs – 20%
- Energy System - Network planning: Digital tools for network planning – 40%
- Energy System - Network planning: Geographical information systems – 30%
- Energy System - Network planning: Data for longer term load forecasting – 50%
- Energy System - Network planning: Load profiles – 50%
- Energy System - Network operation: Automation and fault clearance – 10%
- Energy System - Network operation: Remote switching – 10%
- Energy System - Network operation: Automatic fault indicators – 10%
- Energy System - Network operation: Crew management – 10%
- Energy System - Network operation: Online security assessment – 0%
- Energy System - Network operation: Short-term load forecasting – 20%
- Energy System - Maintenance and asset management: Predictive maintenance – 50%
- Energy System - Maintenance and asset management: Asset management – 60%
- Extreme situations (e.g. pandemic, extreme weather conditions) – 40%

Comments:

- **Master's in Smart Electrical Networks and Systems (SENSE):** Developing a holistic understanding of electric power engineering in combination with entrepreneurial skills.
- **Smart Energy - Mastering the Energy Landscape of the Future:** The program addresses several topics related to different disciplines.
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** The program is not devoted to energy but to digital transformation. However, it tackles several topics that affect the energy system, and indeed, in all editions there is a significant share of energy-company professionals enrolled.
- **Artificial Intelligence MOOC Series:** The Series addresses specifically Ethics, legal issues, platform and technologies for AI

Skill gap areas the included programs plan to cover

- Data management and analysis – 90%
- Big Data – 70%
- Cybersecurity – 40%
- Programming and development competences – 40%

- Other: (Digital organisation) Data platforms – 10%

Q10 In which areas do you plan to cover skill gaps? Select all that apply.

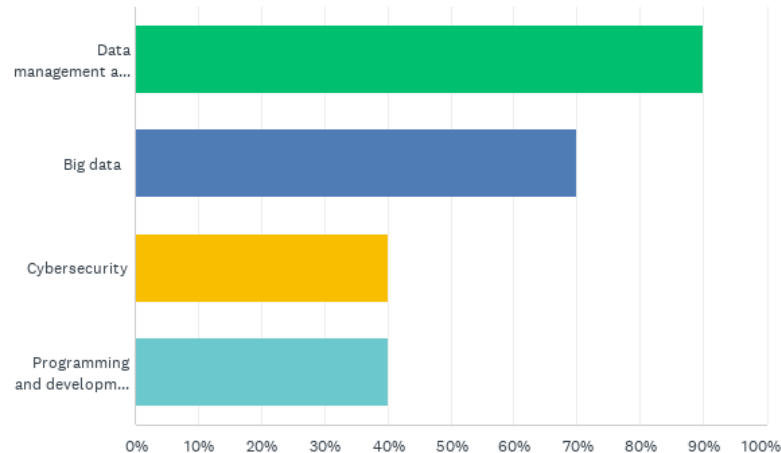


Figure 5 Skill gaps covered data

ISCED codes

- **Master's in Smart Electrical Networks and Systems (SENSE):** 111 Education science, 713 Electricity and energy
- **Smart Distribution Grids:** 713 Electricity and energy
- **Energy Technologies and Sustainable Design:** 712 Environmental protection technology, 73 Architecture and construction, 788 Inter - disciplinary programmes and qualifications involving engineering, manufacturing and construction
- **Smart Energy - Mastering the Energy Landscape of the Future:** 413 Management and administration, 416 Wholesale and retail sales, 417 Work skills
- **EWI Academy:** 488
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** 688 Inter - disciplinary programmes and qualifications involving Information and Communication Technologies (ICTs), 788 Inter - disciplinary programmes and qualifications involving engineering, manufacturing and construction
- **MSc Energy Production and Management:** 713 Electricity and energy
- **Executive Program in Infra Service Management:** 499 Business, administration and law not elsewhere classified, 713 Electricity and energy, 610 Information and Communication Technologies (ICTs) not further defined
- **Master's Degree in Smart Grids:** 610 Information and Communication Technologies (ICTs) not further defined
- **Artificial Intelligence MOOC Series:** 061 Information and Communication Technologies (ICTs), 0619 Information and Communication Technologies not elsewhere classified, 022 Humanities (except languages), 0223 Philosophy and ethics, 048 Inter-disciplinary programmes and qualifications involving business, administration and law, 0488 Inter-disciplinary programmes and qualifications involving business, administration and law

Starting point in program design

- ICT program with an Energy add-on – 30%
- Energy program with an ICT add-on – 70%

Comments:

- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** As commented before, applications of digital technologies to the energy sector are commonplace in the program due to the interests of the students. However, the program is not defined or designed as energy specific.
- **Executive Program in Infra Service Management:** On a managerial level
- **Master's Degree in Smart Grids:** Both
- **Artificial Intelligence MOOC Series:** It's just ICT

Q12 What is the starting point in the design of your program? Select all that apply.

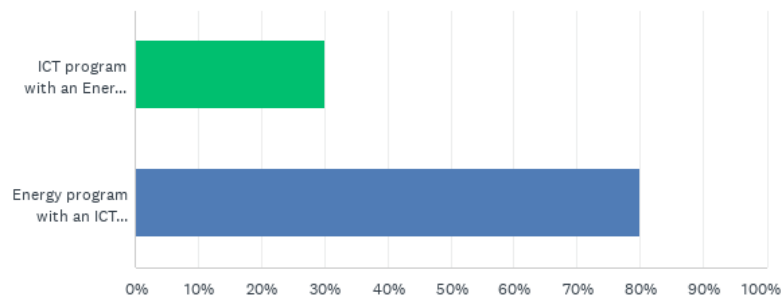


Figure 6 Program starting point data

Funding – Is the program available free of charge?

Three out of the ten programs are offered free of charge.

Comments:

- **EWI Academy:** Offered to Corporations to educate their staff / mostly used for Graduate programs

Q13 Funding - Is the program available for students free of charge?

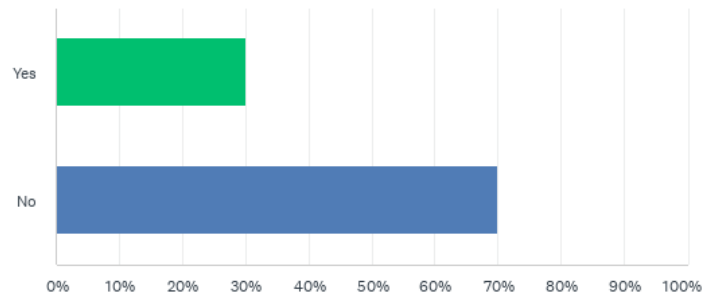


Figure 7 Program financing data

Funding- If the program is not free of charge, what type of funding is available for students?

Based on 7 answers, the programs are 86% corporate-funded and 71% individually-funded.

Comments:

- **Master's in Smart Electrical Networks and Systems (SENSE):** EIT InnoEnergy offers scholarships/fee waivers by selecting the top applicants based on a combination of skills.
- **Smart Energy - Mastering the Energy Landscape of the Future:** The program is a postgraduate certificate program that can either be funded by corporates but also by individuals
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** Most students have the program funded by their corporations.

Q14 Funding - If the program is not free of charge, what type of funding is available for students? Select all that apply.

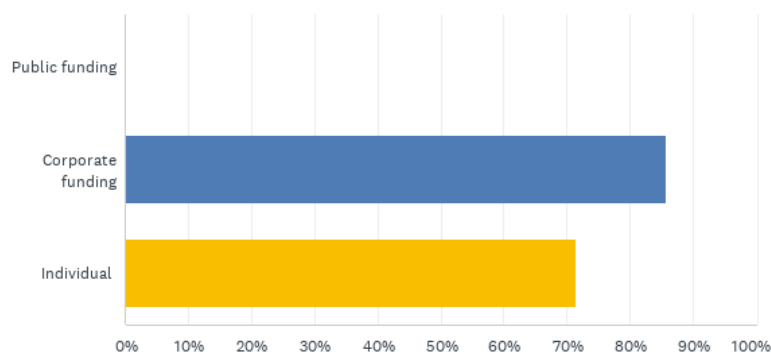


Figure 8 Program fundig model data

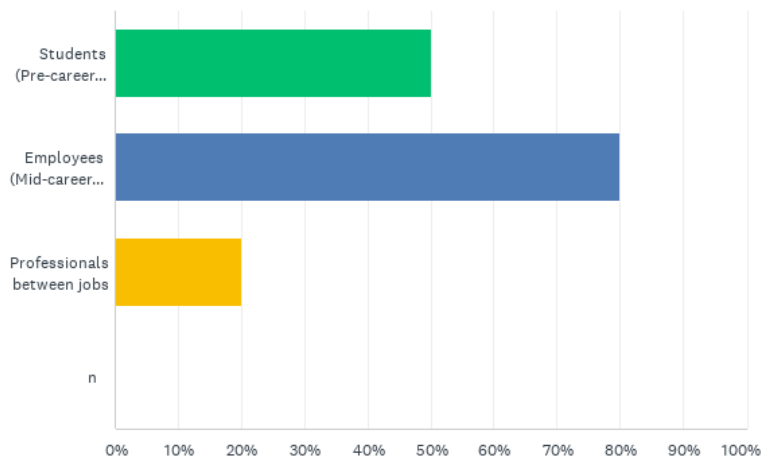
Targets in terms of employment status

- 50% of the programs target Students
- 80% of the programs target Employees
- 20% of the programs target Professionals between jobs

Comments:

- **Smart Energy - Mastering the Energy Landscape of the Future:** The program addresses postgraduates with min. 3 years postgraduate work experience
- **EWI Academy:** It is rather Employees in the early-career stage
- **Executive Program in Infra Service Management:** Senior professionals

Q15 Who do you target in terms of employment status? Select all that apply.



Overall EQF level

Out of the included ten program, one is on Level 5, five is on Level 6 and four is on Level 7.

Q16 What is the overall EQF level of the program?

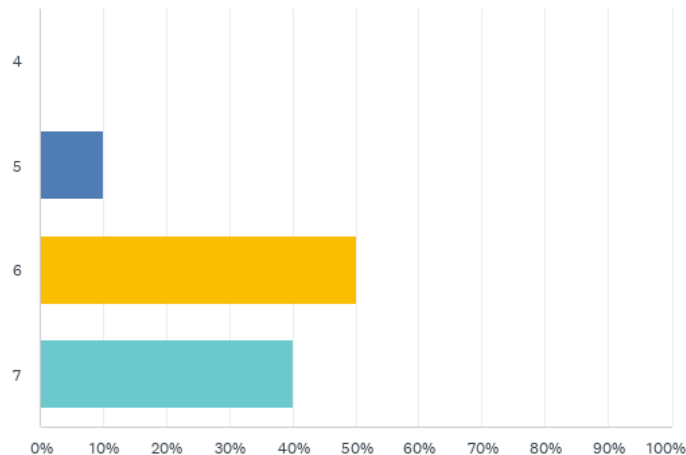


Figure 9 Program EQF level data

Plans for life-long learning

- 9 programs can be combined with a job and one - Energy Technologies and Sustainable Design - is part-time available.
- Four programs provide ECTS credits
Energy Technologies and Sustainable Design – 91 ECTS
MSc Energy Production and Management – 60 ECTS
- 6 programs can be modularized, 1 could be (Executive Program in Infra Service Management) and 1 can be partly modularized (MSc Energy Production and Management)

Comments:

MSc Energy Production and Management: Partly, on second semester

Executive Program in Infra Service Management: Could be

Master's Degree in Smart Grids: Yes, it can be part of a double degree master

- Does it provide any certification? If yes, what type of certification?

Master's in Smart Electrical Networks and Systems (SENSE): Yes, Master's degree

Smart Distribution Grids: Yes. Typhoon HIL Specialist

Energy Technologies and Sustainable Design: Master

Smart Energy - Mastering the Energy Landscape of the Future: Yes

EWI Academy: No

Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation): Yes. An informal certification issued by the ICAI School of Engineering.

MSc Energy Production and Management: MSc degree

Executive Program in Infra Service Management: diploma

Master's Degree in Smart Grids: No, it is not an official master. Comillas and Strathclyde titles are provided.

Artificial Intelligence MOOC Series: No

General comments:

- **Master's in Smart Electrical Networks and Systems (SENSE):** The program is designed for full-time study. However, many of our students follow internships or part-time jobs during their studies.
- **Smart Energy - Mastering the Energy Landscape of the Future:** It is a certificate program

Is the program accredited?

- **Master's in Smart Electrical Networks and Systems (SENSE):** As the program is a double degree program, each education has to follow the national accrediting system. Exactly how this is done varies from country to country. All EIT programs also have an "EIT label". The EIT labeling is preceded by an extensive evaluation process of the "quality" of the program. Next year it has to be renewed.
- **Smart Distribution Grids:** Romanian National
- **Energy Technologies and Sustainable Design:** Cyprus Agency of Quality Assurance and Accreditation in Higher Education
- **Smart Energy - Mastering the Energy Landscape of the Future:** It has been designed
- **EWI Academy:** It is not.
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** It is not accredited by any Spanish Education Institution. As other programmes at Comillas, it is highly oriented to industry, and it works because it is accepted and recognized by companies.
- **MSc Energy Production and Management:** MSc degree
- **Executive Program in Infra Service Management:** By the Head of Education of KTH Executive School
- **Master's Degree in Smart Grids:** At the current stage, the program is not accredited by any external entity.

Certificate provided

- **Master's in Smart Electrical Networks and Systems (SENSE):** After successfully completing the two-year program, a master's degree will be provided from each of the students' two chosen universities.
- **Energy Technologies and Sustainable Design:** MSc
- **EWI Academy:** participation
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** An informal certification issued by the ICAI School of Engineering.
- **Executive Program in Infra Service Management:** diploma
- **Master's Degree in Smart Grids:** At the current stage, the program does not provide any certification.
- **Artificial Intelligence MOOC Series:** It provides a "Certificate of Accomplishment" which does not confer any academic credit, grade or degree

A.2 Data gathered on Business and operational model - Program specification

Relevance of program

- **Master's in Smart Electrical Networks and Systems (SENSE):** The Master's program enables students to develop the technical and entrepreneurial skills needed to design smart grids that integrate renewable energy sources, manage and control power quality, use data-driven applications to enhance electrical solutions, and lead the development of innovations such as battery applications, electric mobility and more.
- **Smart Distribution Grids:** It highlights the main technologies associated with the smart emerging grids, active distribution grids, microgrids and local energy communities. Simulations using Typhoon real-time simulator with HIL and SIL experiments.

- **Energy Technologies and Sustainable Design:** The Interdepartmental Postgraduate Programme Energy Technologies and Sustainable Design» (IPP-ETSD) offers specialization in the discipline of Energy Technologies within the frame of Sustainable Design.
- **Smart Energy - Mastering the Energy Landscape of the Future:** This Smart Energy Certificate Programme examines the complex role digital transformation plays in energy production, distribution and consumption. It also offers practical frameworks for devising a sophisticated deployment strategy. Core elements of digitalisation in the energy transition - demand flexibility methods like dynamic pricing, virtual power plants and smart city management - are approached from a technical as well as systemic angle. From the role of big data and machine learning in real-time digital energy transactions to anticipating the influence of regulatory changes and data privacy developments on consumer behaviour, the programme prepares participants to lead digital transformation inside their organisations.
- **EWI Academy:** The target group for this series is, in particular, lateral entrants and newcomers to the energy industry who would like to gain a compact insight into the most important current topics and a fundamental understanding of the complex economic structures of electricity supply.
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** It is designed to update senior professionals to help them understand how digital technologies may contribute to improving their business, processes, etc.
- **MSc Energy Production and Management:** 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 knowledge through research in this continuously developing field.
- **Executive Program in Infra Service Management:** This program address strategical challenges that energy companies face by creating awareness, ensure understanding of ICT strategical impact and leverage on energy businesses as well as business model and operational opportunities and challenges.
- **Master's Degree in Smart Grids:** Because it responds to the growing demand for engineers, needed to lead the ongoing process of the digitalization of the electric grid.
- **Artificial Intelligence MOOC Series:** The series titled "Introduction to Artificial Intelligence" is aimed at providing technical and non-technical, including historical and political, notions on artificial intelligence for professionals of every sectors. The series investigates why artificial intelligence is nowadays considered the most disruptive enabling technologies up to at least 2050 and gives basic groundings for a preliminary approach to the area. It also deepens ethical issues and national strategies.

Definition of targets

- **Master's in Smart Electrical Networks and Systems (SENSE):** Designing electrical or electronic systems or equipment, ESCO: S1.11.2 – Targeted occupation: Science and Engineering Professionals, ESCO: 21
- **Energy Technologies and Sustainable Design:** Science and Engineering Professionals, ESCO: 21 – Targeted occupation: Architects, Planners, Surveyors and Designers, Building architects, ESCO: 216, 2161 – Tools: providing information regarding designs, materials, energy reservation
Comments: compliance with specifications and quality standards, inspecting sites and consulting clients
- **Smart Energy - Mastering the Energy Landscape of the Future:** Data management and analysis, Big data, additional topics, ESCO: 041 Business and Administration – Targeted occupation: Employees (mid-career stage)
- **EWI Academy:** General Overview of the Energy Industry, ESCO: 242 – Targeted occupation: Regulatory issues, ESCO: 261
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** inter-disciplinary programmes and qualifications involving engineering, manufacturing and construction, ESCO: <http://data.europa.eu/esco/isced-f/0788> - Targeted professionals: Senior profiles aiming at leading digital transformation processes – Tools: Innovative education techniques (case method, flipped classroom, etc.).
- **Executive Program in Infra Service Management:** Strategic implications of ICT in energy businesses – Targeted occupations: Senior Officials, Administrative and Commercial Managers, ESCO: 11, 12

- **Master's Degree in Smart Grids:** ICT, big data analysis, operation and planning of distribution system, power electronics, electricity market regulation – Targeted occupations: Engineers for electric power utilities, electric power and system suppliers, administrative in government and regulatory agencies, energy sector consultants, researchers
- **Artificial Intelligence MOOC Series:** Principles of artificial intelligence, ESCO:
<http://data.europa.eu/esco/skill/e465a154-93f7-4973-9ce1-31659fe16dd2>

Profiles of most important partners

- **Master's in Smart Electrical Networks and Systems (SENSE):**
 - 1) UPC, Grenoble INP, TU/e, KUL, Uppsala University and AGH – Role: University partners
 - 2) ESADE - Business school – Role: Providing an extensive course on Business creation and entrepreneurship
 - 3) Industrial partners – Role: Contribute with study visits, guest lectures, student projects and master thesis projects
- **Energy Technologies and Sustainable Design**
No partners
- **Smart Energy - Mastering the Energy Landscape of the Future**
 - 1) University of Cologne Business School – Role: Host of the course
- **EWI Academy**
 - 1) Large German Utility Companies
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation)**
This program is pushed by the Chair in Smart Industry, which have 12 partners. But we should not say that there are partners from the ICAI School of Engineering perspective.
- **Executive Program in Infra Service Management**
 - 1) Academic faculty
 - 2) Experts – Role: consultants and practitioners

Comments: The operational planning is adapting the curriculum and secure a story line based on - The strategic role of energy companies (history, new demands facing the business, the role of ICT and sustainability) - what is driving change and why - Business design for energy companies -. the role of ICT, cybersecurity, business models, ICT organisation, methods to create value - Take advantage of trends and ICT - platforms, ecosystems, market shaping, big data, - Leadership and change - acting in an uncertain business context
- **Master's Degree in Smart Grids**
 - 1) Comillas Pontifical University – Role: Teaching 30 ECTS
 - 2) Strathclyde – Role: Teaching 30 ECTS
 - 3) Iberdrola – Role: Internship and Master Thesis 30 ECTS

Comments: There is a director and a coordinator in each partner. There is a management board to take decisions related to the operation and planning of the master. Every subject also has a coordinator.
- **Artificial Intelligence MOOC Series**
No partners

A.3 Data gathered on Business and operational model - Program design

Operations management

- **Smart Distribution Grids:** The program is hosted within the Electrical Eng Dept at University Politehnica of Bucharest.
- **Energy Technologies and Sustainable Design:** The Inter-departmental Post-graduate Program “Energy Technologies and Sustainable Design” is offered by the School of Engineering of the University of Cyprus. Program courses are offered by all Engineering School Departments - the Department of Architecture, the Department of Civil and Environmental Engineering, the Department of Electrical and Computer Engineering and the Department of Mechanical and Manufacturing Engineering. The classes and labs are provided by the relevant to each subject department.
- **Smart Energy - Mastering the Energy Landscape of the Future:** yet to be decided
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** The director of the program is in contact with CEOs of local and global companies for them to have lunch with participants on Friday. He is also in charge of the list of professors and the committee which assesses the work of the different groups at the end of the program. Then, there is an administrative assistant who takes care of everything is running smooth, which includes support to participants during enrolling, contact with IT support for professor before and during their lectures, etc.
- **Executive Program in Infra Service Management:** The operational planning is adapting the curriculum and secure a story line based on - The strategic role of energy companies (history, new demands facing the business, the role of ICT and sustainability) - what is driving change and why - Business design for energy companies -. the role of ICT, cybersecurity, business models, ICT organisation, methods to create value - Take advantage of trends and ICT - platforms, ecosystems, market shaping, big data, - Leadership and change - acting in an uncertain business context.
- **Master's Degree in Smart Grids:** There is a director and a coordinator in each partner. There is a management board to take decisions related to the operation and planning of the master. Every subject also has a coordinator.

Plans for finance

- **Master's in Smart Electrical Networks and Systems (SENSE):** EIT InnoEnergy is partly funded by the EU through the European Institute of Innovation and Technology (EIT), and from the contributions of our 26 shareholders. As a commercial company, it is also financed by returns from the innovative products it sells, and the products and companies it invests in.
- **Smart Distribution Grids:** The program is financed as part of a Master Program.
- **Energy Technologies and Sustainable Design:** There are no sponsorships or subsidies/grants Students pay their own tuition. The fees for Master degrees are: €5.125.
- **Smart Energy - Mastering the Energy Landscape of the Future:** Via Tuition (9.750 €)
- **EWI Academy:** Paid by corporations for their staff. Price depending on booked modules and participants.
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** The tuition finances the program.
- **MSc Energy Production and Management:** The program is public and free of charge.
- **Executive Program in Infra Service Management:** The program fee is 15000 Euro per participant.
- **Master's Degree in Smart Grids:** The program is fully funded by the student's tuition fees.
- **Artificial Intelligence MOOC Series:** The University (POLIMI) will provide all the resource in terms of maintenance of the series on the POLIMI OPEN KNOWLEDGE PLATFORM (<https://www.pok.polimi.it/>)

Use of resources and physical/ virtual facilities

- **Master's in Smart Electrical Networks and Systems (SENSE):** The first year of the program is at KTH Royal Institute of Technology in Sweden, and the students select the second year university to follow at

one of four universities below: - Grenoble INP: Institute of Technology, France - KU Leuven, Belgium - UPC: Universitat Politècnica de Catalunya · BarcelonaTech, Spain - TU/e: Eindhoven University of Technology, the Netherlands

- **Smart Distribution Grids:** For simulations, students will need a laptop. The other experiments tools are provided by the existing infrastructure in the lab.
- **Energy Technologies and Sustainable Design:** Physical facilities in each department are used, electrical and computer engineering department provides the Photovoltaic technology lab.
- **Smart Energy - Mastering the Energy Landscape of the Future:** On-Campus within the facilities of the University of Cologne Business School
- **EWI Academy:** Only online
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** The program takes place in a classroom, but it is offered in a blended format, so it is possible for participants to virtually attend classes, which requires the classroom to be equipped with camera, microphone, etc. Of course, we also require IT support for that.
- **MSc Energy Production and Management:** The resources needed for the program is just lecture classes.
- **Executive Program in Infra Service Management:** We use a faculty of experts in the specified fields. We used flipped class room - so we have recorded key elements that we process. We use IRL facilities.
- **Master's Degree in Smart Grids:** Teaching rooms and laboratories. Tools for remote connection during covid-19.
- **Artificial Intelligence MOOC Series:** We need the platform <https://www.pok.polimi.it/>. The program could be soon uploaded on COURSERA (<https://www.coursera.org/polimi>).

Does the program generate output which needs to be licensed?

Q26 Does the program generate output which needs to be licensed?

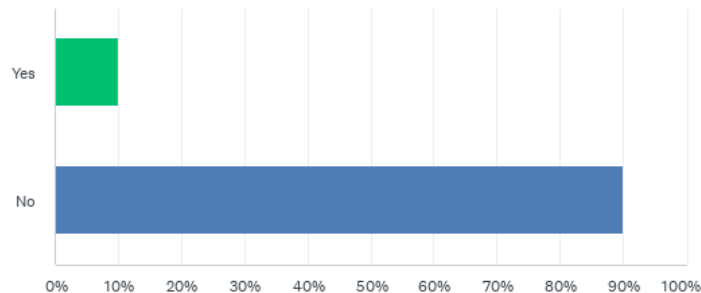


Figure 10 Licensed output data

- **Artificial Intelligence MOOC Series:** The MOOCs are licensed under a Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>)

Marketing and student recruitment

- **Master's in Smart Electrical Networks and Systems (SENSE):** Operating at the centre of the energy transition, EIT InnoEnergy builds connections worldwide, bringing together innovators and industry, entrepreneurs and investors, graduates and employers. It is the largest sustainable energy innovation ecosystem in the world and supports the SENSE master's program. The applications will be checked by the Admissions Office for general eligibility. The program selection committees will then check whether

the applicants fulfil the program-specific eligibility criteria. Eligible candidates are then evaluated and ranked based on a range of criteria, such as grades, scores or GPA, the content of previous studies, the quality of your previous universities, and other relevant experience. There are no tests or interviews in the selection process.

- **Smart Distribution Grids:** The program is mandatory for first year master. The advertising is made using the UPB website and Faculty website
- **Energy Technologies and Sustainable Design:** Program is promoted in all engineering school departments with presentations. Hard copy and electronic Flyers are regularly sent to professional engineering bodies in the country.
- **Smart Energy - Mastering the Energy Landscape of the Future:** Marketing through the University of Cologne Business School
- **EWI Academy:** Acquisition through the network of the Institute
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** The program is mainly offered to industrial companies in Madrid. The marketing effort required is becoming less intense as the program alumni recommend it to pairs. The main pattern in the recruiting process is a company offering the program to an employee as part of her long life learning process.
- **MSc Energy Production and Management:** Promotion of the program could be realized through informative conferences. Also, through 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.
- **Executive Program in Infra Service Management:** Through alumni - Targeted e-mail - Direct sales
- **Master's Degree in Smart Grids:** The program is promoted by marketing in Social Networks, websites and by promoting activities with current students that may attract attention from future students.
- **Artificial Intelligence MOOC Series:** Social accounts (<https://twitter.com/pokpolimi>, <https://www.facebook.com/polimiopenknowledge/>), and University internal dissemination

A.4 Data gathered on Business and operational model - Implementation and success records

Certification – Types of certificate

- **Smart Distribution Grids:** Typhoon HIL, Matlab
- **Energy Technologies and Sustainable Design:** none
- **Smart Energy - Mastering the Energy Landscape of the Future:** yet to be decided
- **EWI Academy:** none
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** For its design, and target profiles, this program does not require to be certified. Nevertheless, the ICAI School of Engineering expedes a certificate for participants.
- **Executive Program in Infra Service Management:** Board review of methods and review of participating companies adaptation strategies
- **Master's Degree in Smart Grids:** Currently, there is no external certification
- **Artificial Intelligence MOOC Series:** No certification

Recruitment targets in terms of targeted skill gaps and content

- **Master's in Smart Electrical Networks and Systems (SENSE):** The target skills are to develop the technical and entrepreneurial skills needed to design smart grids that integrate renewable energy sources, manage and control power quality, use data-driven applications to enhance electrical solutions, and lead the development of innovations such as battery applications, electric mobility, and more. The program focuses on innovative solutions that are relevant to electric power.

- **Energy Technologies and Sustainable Design:** European energy efficiency introduction classes for buildings and means of achieving higher classes for the various cases. Technology issues New materials Energy conservation Heating and cooling Distributed energy generation for architects Net-metering and net-billing mechanisms Subsidies and schemes
- **Smart Energy - Mastering the Energy Landscape of the Future:** open due to Covid-19
- **EWI Academy:** The target group for this series is, in particular, lateral entrants and newcomers to the energy industry who would like to gain a compact insight into the most important current topics and a fundamental understanding of the complex economic structures of electricity supply.
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** We target professionals with from 5 to 15 years of experience who require a deeper understanding of when technology may improve her company, and when it may not, i.e. professionals who aspire to leading digital transformation processes.
- **Executive Program in Infra Service Management:** We provide participants with clear view of our agenda with Clear learning objectives as well as clear personal impact objectives. We are based on our curriculum setting Impact objectives together with participants for organizational impact.
- **Master's Degree in Smart Grids:** ICT, big data analysis, operation and planning of distribution system, power electronics, electricity market regulation
- **Artificial Intelligence MOOC Series:** No specific targets

Financial targets in terms of profit and sustainability

- **Master's in Smart Electrical Networks and Systems (SENSE):** InnoEnergy as a whole has the financial target to run the different InnoEnergy programs completely on tuition fees. Presently 18 k€/student/year.
- **Energy Technologies and Sustainable Design:** Departments consider the number of students taking the program needs to be higher than 25 in order to be run sustainably.
- **Smart Energy - Mastering the Energy Landscape of the Future:** open due to Covid-19
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** 16-20 participants, which is the program target for optimal working dynamics reasons, make the program economically sustainable.
- **Executive Program in Infra Service Management:** 15 -20 participants annually
- **Master's Degree in Smart Grids:** The program does not seek any profit objectives. It is only after being financially sustainable.
- **Artificial Intelligence MOOC Series:** No financial targets

A.5 Data gathered on Learning and teaching model - Program design

Target groups

- **Master's in Smart Electrical Networks and Systems (SENSE):** Graduated students of Bachelor's in electrical engineering, physical engineering, mechanical engineering, electronic engineering or any energy-related engineering subject.
- **Energy Technologies and Sustainable Design:** 21 Science and engineering professionals conducting research, enlarging, advising on or applying scientific knowledge obtained through the study of structures and properties of physical matter and phenomena, chemical characteristics and processes of various substances, materials and products, all forms of human, animal and plant life and of mathematical and statistical concepts and methods; advising on, designing and directing construction of buildings
- **Smart Energy - Mastering the Energy Landscape of the Future:** mid-career employees/ lower top management
- **EWI Academy:** The target group for this series is, in particular, lateral entrants and newcomers to the energy industry who would like to gain a compact insight into the most important current topics and a fundamental understanding of the complex economic structures of electricity supply. ESCO: Mostly 24

- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** All occupations under code 13 Also, codes 214 and 215
- **Executive Program in Infra Service Management:** 11 Chief Executives, Senior Officials and Legislators; 12 Administrative and Commercial Managers
- **Master's Degree in Smart Grids:** Electrical and telecommunication engineers
- **Artificial Intelligence MOOC Series:** Professionals <http://data.europa.eu/esco/isco/C2> ; Technicians and associate professionals <http://data.europa.eu/esco/isco/C3>

Admission requirements

- **Master's in Smart Electrical Networks and Systems (SENSE):** Bachelor degree - English language proficiency, 60 ECTS credits or equivalent from your Bachelor's degree must be in the area of electrical engineering, 30 ECTS credits or equivalent from your Bachelor's degree must be in mathematics, applicants must have achieved an average grade of at least 75%.
- **Smart Distribution Grids:** Bachelor degree
- **Energy Technologies and Sustainable Design:** Bachelor degree, Graduate
- **Smart Energy - Mastering the Energy Landscape of the Future:** Graduate
- **EWI Academy:** Master degree, Graduate
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** No requirements
- **MSc Energy Production and Management:** Bachelor degree, Master degree - Degree from Greek Polytechnic schools which award 5 year integrated Bachelor and Master's
- **Executive Program in Infra Service Management:** Master degree - Senior management
- **Master's Degree in Smart Grids:** Bachelor degree, Graduate
- **Artificial Intelligence MOOC Series:** No requirements

Q32 What are the admission requirements?

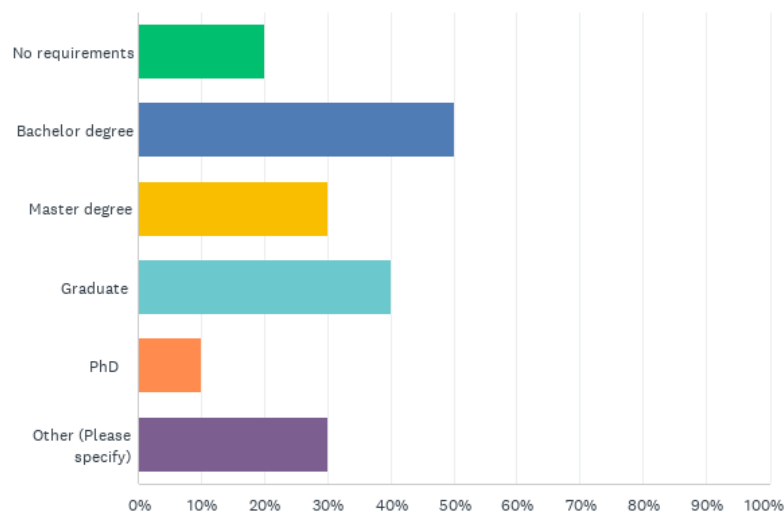


Figure 11 Admission requirements data

Training goals

- **Master's in Smart Electrical Networks and Systems (SENSE):** Master's in Smart Electrical Networks & Systems adds depth to students' studies while they engage directly with some of the biggest and most exciting companies in the field, meet business and technical experts, gain hands-on experience, and start building their own personal European network.
- **Smart Distribution Grids:** Students will understand how the smart distribution grids work, what are the technologies, the challenges, etc.
- **Energy Technologies and Sustainable Design:** Sustainability understanding efficiency understanding economic assessment of technologies skills Right choice of materials for the different types of construction Energy assessments
- **Smart Energy - Mastering the Energy Landscape of the Future:** On an organizational level? – support strategy development, support digital transformation. On an individual level? – form and educate leaders for energy sector
- **EWI Academy:** The workshop series offers an overview of current topics in the energy industry. To this end, the fundamentals of power supply and electricity markets and the most important trends are presented vividly.
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** Participants work on a digital transformation case. At the end of the program, it is possible to assess whether participants are able to focus on applying technologies to maximize their added value.
- **Executive Program in Infra Service Management:** This program addresses strategical challenges that energy companies face by - creating awareness - ensure understanding of ICT strategical impact and leverage on energy businesses as well as - business model and operational opportunities and challenges for energy companies.
- **Master's Degree in Smart Grids:** Train engineers to understand both the power system, telecommunications and regulatory aspects.
- **Artificial Intelligence MOOC Series:**

MOOC 1: Artificial Intelligence: An Overview
WEEK 1 explains the seminal ideas leading to the birth of AI, the major difficulties and how the international community overtook them. WEEK 2 describes what AI is today in terms of goals, scientific community, companies' interests. WEEK 3 describes the taxonomy of the know-how on AI in terms of techniques, software and hardware methodologies, and how they are related to each other. WEEK 4 explains the need for national strategies on AI. WEEK 5 identifies the major Italian and European players on AI and their scope.

MOOC2: Ethics of Artificial Intelligence
Week 1 describes the reasons for an ethical analysis applied to AI and Recognizes how the notion of responsibility is challenged when designing and using AI tools. Week 2 identifies the ethical and social impacts and implications of AI. Recognize and analyze ethical and social issues inherent in AI by means of examples and case-studies analyzed with the use of the main ethical frameworks. Week 3: Learn how to analyze problems through an ethical lens. Use critical skills in clarifying and ethically analyzing AI in different domains of life. Week 4: Critically analyze the current policies for AI. Use ethical and socially responsible principles in your professional life.

MOOC3: Artificial Intelligence and legal issues
Week 1 - Recognize that the use of AI requires to be analysed, evaluated and addressed also from a legal point of view. Week 2 - Indicate the main legal concepts of liability for the conduct and choices made by or through intelligent systems and compensation for any consequential damage. Identify the practical impacts of responsibility and compensation for damages caused from AI, with specific reference to case-studies. Verify whether and which criminal law principles apply when an offence is committed by an AI system. Week 3 - Recognize the difference between copyright and patent with respect to the protection of AI systems created. Identify legislative gaps with respect to the protection of works created autonomously by AI. Week 4 - Recognize the risks to fundamental rights and freedoms deriving from non-regulated uses of AI. Identify the principal conditions for data processing and the limits set out by the law to protect privacy and human rights.

MOOC4: Technologies and platforms for Artificial Intelligence
Week 1 - Describe the technological scenario of AI (Cloud, Edge, IoT) from an IT perspective. Week 2 - Explain the Cloud-based approaches for AI comprising machine- and deep-learning-as-a-service. Describe the role of Hardware Accelerators in the growth of AI. Week 3 - Identify the Machine and Deep Learning techniques and solutions developed for IoT and Edge Computing systems. Week 4 - Explain

the main challenges and opportunities of technologies and platforms for AI.

Detailed description of program content

- **Master's in Smart Electrical Networks and Systems (SENSE):** All students follow their first year of studies at KTH: Royal Institute of Technology, in Stockholm, Sweden. There, you focus on the fundamentals of electric energy systems, including power systems, power electronics, electrical machines, renewable generation, high-voltage engineering and more. Students also take part in the program's European Modules which cover topics such as energy efficiency, storage options, energy generation, and more. Students learn from experts located across the continent at our partner universities and engage in industry visits to companies such as ABB and Scania, leaders in the electrification of the transport industry in Sweden. For the second year, students choose an area in which to specialize at one of four universities: - Energy Management in Buildings and Power Grids at Grenoble INP: Institute of Technology, France - Power Distribution and Storage, at KU Leuven, Belgium - Power Electronics as Enabling Technology for Renewable integration, at UPC: Universitat Politècnica de Catalunya - BarcelonaTech, Spain - Sustainable Electrical Energy Systems, at TU/e: Eindhoven University of Technology, the Netherlands Students complete the second and final year with a Master's thesis, which they undertake at one of EIT industrial or research partners.
- **Energy Technologies and Sustainable Design:** ECTS MME 516 Renewable Energy Technology 8, POL 500 Basic Principles of Interdisciplinary Engineering 1, POL 601 Graduate Seminar 1, POL 604 Capstone Design and Research Project 1, 8 CEE 536 Energy Efficiency of Buildings 8 ARH 538 Environmental Building Design 8 ECE 687 Building Integration of Photovoltaic (PV): Towards nearly zero energy buildings (NZEB) 8 POL 700 Engagement With Practice and Industry 1 POL 704 Capstone Design and Research Project II 8 POL 804 Capstone Design Research Project III 8 Electives from all departments available"
- **Smart Energy - Mastering the Energy Landscape of the Future:** Module 1 Transforming the Energy Business -Understand the essentials of energy, digitalisation and data analytics -Learn the most important fundamentals regarding today's energy landscape. -Be able to assess the impact of digitalisation on the modern energy sector. -Learn about future developments and the influence of innovation in the energy landscape. Module 2 Smart Mobility -Learn about the history of transportation from the industrialisation age up to today and gain an outlook into future developments and new business models. -Gain insights into different energy sources for transportation and their advantages and disadvantages regarding economics and sustainability. -Assess the impact of mobile solutions with the help of modern data analysis techniques. Module 3 Smart Customer and Home -Be up to date on the latest developments and innovations in home automation and learn about its risks and opportunities. -Gain insights into human behaviour and preferences, including non-monetary preferences in energy. -Learn about the analytic potential of data gained from Smart Home technology. Module 4 Smart City and Infrastructure -Learn about the newly defined role of cities and their infrastructures in the digital era. -Gain insights into energy infrastructures, their implications, and the regulatory framework surrounding them. -Get to know the latest methods and technology in the energy sector including: Blockchain, Smart Contracts, Energy Virtualisation and Urban Analytics.
- **EWI Academy:** 1. Energy Management Compact, 2. Crash course energy scenarios, 3. Hydrogen economy - challenges and opportunities, 4. E-Mobility - Challenges and Opportunities
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):**
<https://www.comillas.edu/postgrado/programa-avanzado-en-industria-conectada>
- **MSc Energy Production and Management:** Successful completion of studies requires: 1.adequate attendance of all courses and workshops 2.successful examination in all courses 3.elaboration of a postgraduate thesis and successful examination
- **Executive Program in Infra Service Management:** The operational planning is adapting the curriculum and secure a story line based on - The strategic role of energy companies (history, new demands facing the business, the role of ICT and sustainability) - what is driving change and why - Business design for energy companies - the role of ICT, cybersecurity, business models, ICT organisation, methods to create value - Take advantage of trends and ICT - platforms, ecosystems, market shaping, big data, - Leadership and change - acting in an uncertain business context

- Master's Degree in Smart Grids:** First period (Comillas) 30 ECTS Fundamentals of Power Systems or Fundamentals of Telecommunications Regulations and New Business Models Operation and Planning of Future Distribution Networks Telecommunications Regulations for Smart Grids Leadership, Change Management and Corporate Responsibility Second period (Strathclyde) 30 ECTS Data Analytics and AI for Energy System Control and Protection of Future Networks Offshore and Pan European Supergrids Hardware IoT Communications System Design Power Electronics for Transmission and Distribution Networks 5G Communications Networks Third period (Iberdrola) Internships + Master Thesis
- Artificial Intelligence MOOC Series:** MOOC1: Artificial Intelligence: An Overview, The course is structured in 5 weeks: Week 1: History of AI, Week 2: AI Today, Week 3: AI Research Areas Week 4: AI National Strategies Week 5: Italian and European Players In particular, Week 1 introduces the history of AI explaining what AI is, when it was born and its phases. Week 2 explores the situation of AI today focusing on its goals, its problems and progresses in the scientific community and companies. Week 3 explores research areas, while Week 4 examines national strategies in the USA, in China and in Europe. Finally, Week 5 focuses on Italian and European players: MISE, CINI Labs, AlxIA, and European Networks of Excellence. MOOC2: Ethics of Artificial Intelligence, The course is organized in 4 weeks. Week 1: Ethics, AI and Responsibility Week 2: Case-studies, examples and ethical frameworks Week 3: Issues and challenges Week 4: Governance and policies In particular, Week 1 introduces the concepts of ethics, AI and moral responsibility, explaining why it is necessary to consider ethical issues in AI and the relationship between responsibility and AI; Week 2 and 3 explore different ethical frameworks, case-studies, examples, such as digital medicine, sustainability, cybersecurity, analyze privacy in relation to AI and the so called moralizing technologies and their issues. . Week 4 introduces some of the issues about governance of AI and presents some of the current policies for AI. MOOC3: Artificial Intelligence and legal issues. The course is structured in 4 weeks. Week 1 – Artificial Intelligence, Law and legal issues Week 2 – Artificial Intelligence and Liability, Week 3 – Artificial Intelligence and Intellectual Property, Week 4 – Artificial Intelligence and risks to fundamental rights. In particular, Week 1 will introduce the topic of Artificial Intelligence and the state of the art of its regulation at legislative level. The main legal issues will also be introduced. In Week 2 the liability aspects of using and manufacturing Artificial Intelligence will be analysed, focusing on the existing legal framework about civil liability both arising from contractual and non-contractual damages and eventually about criminal liability. Week 3 will focus on Artificial Intelligence systems's intellectual property aspects, both in terms of the protection of the AI system created and the protection of the work created by an AI system. Week 4 focuses on the risks to fundamental rights arising from the usage of Artificial Intelligence, such as privacy, information and massive surveillance and related potentially compressed freedoms. MOOC4: Technologies and platforms for Artificial Intelligence, The course is structured in 4 weeks. Week 1: IT and AI, Week 2: AI on the cloud, Week 3: Embedded and Edge AI, Week 4: Challenges and opportunities. In particular, Week 1 explains the IT perspective for AI and describes hardware technologies for AI; Week 2 focuses on AI on the Cloud by exploring the typical architecture of Cloud-based AI applications and the role of AI hardware accelerators (i.e., GPU, TPU and FPGA). Week 3 is about Embedded and Edge AI, and finally Week 4 explores challenges and opportunities for AI and technologies. In particular, Week 1 explains the IT perspective for AI and describes hardware technologies for AI; Week 2 focuses on AI on the Cloud by exploring the typical architecture of Cloud-based AI applications and the role of AI hardware accelerators (i.e., GPU, TPU and FPGA). Week 3 is about Embedded and Edge AI, and finally Week 4 explores challenges and opportunities for AI and technologies.

Teaching and evaluation methods

- Master's in Smart Electrical Networks and Systems (SENSE):** All possible teaching and evaluation methods are used like lectures, exercises, seminars, projects, laboratory exercises, internships, etc. Evaluation methods vary from written exams, project reports, oral presentations, short written tests.
- Energy Technologies and Sustainable Design:** Lectures Tutorials Labs Exams
- Smart Energy - Mastering the Energy Landscape of the Future:** yet to be decided
- EWI Academy:** Live surveys
- Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** Classes are scheduled to deliver the required tools for participants to work on their cases. Professors use innovative methods like the

flipped classroom, etc. For the seniority of participants, evaluation is performed in a qualitative way, with a personalized detailed report at the end of the program.

- **MSc Energy Production and Management:** Teaching methods include lectures in class but also lab facilities so the students get hands on experience with the equipment. Final exams but also, half-year reports in some courses are the evaluation methods.
- **Executive Program in Infra Service Management:** A combination of Flipped class room, Action based learning, Traditional learning, Case based learning
- **Master's Degree in Smart Grids:** Combination of theory exams, tests, practices and laboratory reports, and analysis of practical cases.
- **Artificial Intelligence MOOC Series:** To successfully complete this course, and henceforth receive the certificate of accomplishment, it is necessary to pass the weekly quizzes with 60% or more.

Use of digital tools

- **Master's in Smart Electrical Networks and Systems (SENSE):** The teachers use in general many teaching methods based on digital tools such as different LMS systems like Canvas. InnoEnergy has partnered with Learnify Repository for collecting and sharing developed digitalized tools. These tools can be anything from small Matlab mlx examples to more advanced game types of software. InnoEnergy has invested in at least one Virtual Hybrid Class Room (VHCR) in each university (based on zoom). These rooms provide the opportunity to use hybrid forms of teaching.
- **Energy Technologies and Sustainable Design:** Virtual labs on PVs and zero energy buildings are integral part of the program
- **Smart Energy - Mastering the Energy Landscape of the Future:** yet to be decided
- **EWI Academy:** Zoom and Live surveys
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** All the tools required for virtual teaching. Specific applied tools like virtual reality and others, oriented to make participants understand their disruptive potential.
- **MSc Energy Production and Management:** The program is trying to adjust to the digital transformation in all sectors. Digital tools relevant to the requirements of the aims of each course are used. Such tools include programming tools like MATLAB, Simulink, Smath, EnergyPlus, Python, TEE-KENAK (Greek standard for electrical installations).
- **Executive Program in Infra Service Management:** LMS
- **Master's Degree in Smart Grids:** By using digital tools (MATLAB/MATPOWER, Python, etc.) it is possible to simulate real cases to better understand the concepts.
- **Artificial Intelligence MOOC Series:** The course is uploaded on a digital platform and it is totally asynchronous.

Does the program include internships or “on-the-job” training?

- **Master's in Smart Electrical Networks and Systems (SENSE):** - Year 1 students take an Industrial Innovation Project where they work in close collaboration with industry players on developing innovative solutions to some of the problems they face. - In the summer between your first and second year, students attend a four-week course on entrepreneurship at the ESADE Business School in Barcelona. - The Battle of Green Talent is an online entrepreneurship competition designed for all EIT InnoEnergy students. During 6 months, students transform their bright ideas into promising businesses while competing with peers, interacting with virtual investors from top business schools around the world, and getting advice from experienced business creation professionals. - Year 2 students undertake master thesis at one of the program's industry partners.
- **Energy Technologies and Sustainable Design:** Laboratory work as part of final project.
- **Smart Energy - Mastering the Energy Landscape of the Future:** No, but one Capstone Seminar
- **EWI Academy:** No

- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** No. Participants are indeed working at their companies during the program.
- **MSc Energy Production and Management:** The program provides the students in the last year with career opportunities, providing information for job vacancies in several energy entities.
- **Executive Program in Infra Service Management:** No
- **Master's Degree in Smart Grids:** Yes, it includes an internship and Master Thesis of 30 ECTS in Iberdrola.
- **Artificial Intelligence MOOC Series:** No

General program schedule

- **Master's in Smart Electrical Networks and Systems (SENSE):** SENSE master's program is a full-time two-year program.
- **Energy Technologies and Sustainable Design:** Three semester program - Can be extended for part time students by allowing to be extended up to 3 years.
- **Smart Energy - Mastering the Energy Landscape of the Future:** intensive short course
- **EWI Academy:** intensive short course
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** The program duration is 6 months, but the equivalent load is only 16 ECTS. It takes place on Friday afternoon and Saturday morning for professionals to conveniently attend classes.
- **Executive Program in Infra Service Management:** 4 modules, three days each
- **Master's Degree in Smart Grids:** One year course, from September to mid-May in Comillas and Strathclyde, and then an internship and thesis master in Iberdrola from mid-May to early September.
- **Artificial Intelligence MOOC Series:** 4 Short courses of 5 (MOOC1) or 4 weeks (MOOC 2, 3 and 4). Each MOOC has an estimated effort of 1-2 hours per week.

Certification criteria

- **Energy Technologies and Sustainable Design:** Fulfill the assessment requirements of all courses and labs
- **Smart Energy - Mastering the Energy Landscape of the Future:** Min 3 Years of postgraduate work experience
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** We mainly measure their performance by assessing their work on their case.
- **MSc Energy Production and Management:** The certification criteria for joining the program are: the general degree of the diploma / degree, the order of the diploma / degree in relation to the grades of the other graduates in the same School / Department and academic year, the score in the undergraduate courses that are related to the postgraduate program, the performance in the diploma thesis, where it is foreseen at the undergraduate level, any other postgraduate qualifications related to the subject of the IPR, the research, professional and / or technological activity of the candidate, knowledge of foreign languages and at least English, and for foreigners the knowledge of the Greek language, letters of recommendation.
- **Executive Program in Infra Service Management:** Completion and engagement during the modules
- **Master's Degree in Smart Grids:** Students must pass all subjects in order to get the master's degree from both Universities.
- **Artificial Intelligence MOOC Series:** No certification

A.6 Data gathered on Learning and teaching model - Implementation and success records

Target results for individual certification

- **Energy Technologies and Sustainable Design:** No individual certification
- **Smart Energy - Mastering the Energy Landscape of the Future:** yet to be decided
- **EWI Academy:** obtain a high level Overview of the Energy sector
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** Again, this is made in a qualitative way. We assess whether they are able to apply digital technologies to maximize their added value to the company.
- **Executive Program in Infra Service Management:** NA
- **Master's Degree in Smart Grids:** Currently, only titles by Strathclyde and Comillas are provided. Currently, no official individual certification is provided.
- **Artificial Intelligence MOOC Series:** No targets

Target results for program certification

- **Energy Technologies and Sustainable Design:** All programs of study in the country provided by the Graduate School of the University of Cyprus are accredited by The Cyprus Agency of Quality Assurance and Accreditation in Higher Education (CYQAA).
- **Smart Energy - Mastering the Energy Landscape of the Future:** yet to be decided
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** Not applicable.
- **Executive Program in Infra Service Management:** NA
- **Master's Degree in Smart Grids:** Currently, there is no official certification of the program.
- **Artificial Intelligence MOOC Series:** No targets

Expectations for alumni engagement

- **Master's in Smart Electrical Networks and Systems (SENSE):** It is really the plan to have them in the ecosystem of InnoEnergy during their lifetime. Hopefully, they also create start-ups, etc.
- **Energy Technologies and Sustainable Design:** Alumni are expected to promote the program usefulness within the engineering community engaged in new building designs and refurbishments.
- **Smart Energy - Mastering the Energy Landscape of the Future:** Limited due to the short time frame
- **EWI Academy:** None
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** We indeed have a formal mechanism for alumni to keep in touch. They are established as a community which meets once a month. In these meetings, they invite a professional who presents a technology or a good practice to the Advanced Program Alumni community.
- **Executive Program in Infra Service Management:** Yearly meeting and base for future recruitment
- **Master's Degree in Smart Grids:** Alumni engagement is carried out by involving the alumni in talks where they explain to students currently taking the program what their jobs after the master are like. Also, yearly meeting are created to help alumni stay connected between different cohorts.
- **Artificial Intelligence MOOC Series:** -

Expectations for employment feedback

- **Master's in Smart Electrical Networks and Systems (SENSE):** Around 94% of students are employed within six months after graduation. The most common job titles of the graduates are business dev. engineer, data/energy analyst, design engineer, energy management project engineer, and more. The top employers of the graduates are ABB, ASML, Deloitte, ENGIE, EDF, Fraunhofer, Siemens, McKinsey & Company.
- **Energy Technologies and Sustainable Design:** Employees are expected to consider the program as desirable qualification.
- **Smart Energy - Mastering the Energy Landscape of the Future:** Positive, since their mid-career employees are enhanced to take on the next step.
- **EWI Academy:** Throughout positive so far
- **Programa Avanzado en Industria Conectada, Liderazgo y Transformación Digital (Advanced Program in Smart Industry, Leadership and Digital Transformation):** Employers are regularly offering the program to their employees, edition after edition, which we regard as the best feedback from companies.
- **MSc Energy Production and Management:** Employers can upskill or reskill employees by acquiring a strong theoretical background in the field of energy production, management and methods of energy saving, but also in the policy and regulation in the constantly changing energy sector.
- **Executive Program in Infra Service Management:** They are positive - we intend to make an impact from each module that the employer will experience.
- **Master's Degree in Smart Grids:** Response is very good. All students are employed after doing the master.
- **Artificial Intelligence MOOC Series:** We do not gather feedback from employers, but the MOOCs series offer an overview of a disruptive technology in a small amount of time.

Appendix B – Program template

This appendix consists of the Program template, with only pre-selected data.

Program fact sheet

Name of program

Program category

Existing Future envisioned

Flagship program

Yes

Program format

On-campus/ on-site;

Live virtual

Online

Blended

Program language

Length of program

Industrial challenges addressed

Select from the below

- Economic and Organizational - High economic costs
- Economic and Organizational - Business model adaptation
- Economic and Organizational – Funding
- Economic and Organizational - Low top management commitment
- Economic and Organizational - Goals/target-tracking
- Social - Privacy concerns
- Social - Loss of jobs due to automatic processes
- Social - Acceptance of new technologies
- Social - Lack of citizen engagement
- Technical and Regulatory - IT security issues
- Technical and Regulatory - Reliability and stability need for machine to machine communication
- Technical and Regulatory - Need to protect industrial know-how
- Technical and Regulatory - Lack of adequate skills from employees
- Technical and Regulatory - Data Management
- Technical and Regulatory - Data protection issues
- Technical and Regulatory - Technology integration (compatibility with existing processes/technologies)
- Technical and Regulatory - Lack of regulation standards and forms of certification
- Technical and Regulatory - Unclear legal issues

- Energy System - Customers: Remote services to customers
- Energy System - Customers: Dedicated information about their energy profiles
- Energy System - Customers: Remote fault announcement
- Energy System - Customers: Remote metering
- Energy System - Customers: Remote fault repairs
- Energy System - Network planning: Digital tools for network planning
- Energy System - Network planning: Geographical information systems
- Energy System - Network planning: Data for longer term load forecasting
- Energy System - Network planning: Load profiles
- Energy System - Network operation: Automation and fault clearance
- Energy System - Network operation: Remote switching
- Energy System - Network operation: Automatic fault indicators
- Energy System - Network operation: Crew management
- Energy System - Network operation: Online security assessment
- Energy System - Network operation: Short-term load forecasting
- Energy System - Maintenance and asset management: Predictive maintenance
- Energy System - Maintenance and asset management: Asset management
- Extreme situations (e.g. pandemic, extreme weather conditions)

Skill gap areas

- Data management and analysis;
- Big Data;
- Cybersecurity;
- Programming and development competences

ISCED code of program content

Starting point of program design

- ICT program with an energy add-on
- Energy program with ICT add-on

Program funding

Free of charge to student?

- Yes
- No

If No, how is it funded:

- Public funding
- Corporate funding,
- Individual funding

Target groups

- Students (Pre-career stage)
- Employees (Mid-career stage)
- Professionals between jobs

EQF level

Select EQF level from 4 to 7.

Lifelong learning and certification

Accreditation and certification

Business and operational model

Program specification

Relevance of program

Definition of targets

Partner profiles

Program design

Operations planning

Financial structure

Use of resources

Licences for digital tools

Yes No

Marketing and student recruiting procedures

Implementation and success records

Certificates and certification methods

Recruiting success

Financial success

Learning and teaching model

Program design

Participant profiles

Admission requirements

- No requirements,
- Bachelor degree,
- Master degree,
- Graduate,
- PhD,
- Other.

Training goals

Program content

Teaching and evaluation methods

Use of digital tools

Internships

Scheduling

Certification criteria

Implementation and success records

Individual certification results

Program certification results

Alumni engagement

Employer feedback