GREEN SKILLS

At Vocational Education

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"Comparative report about the curricula for electricians on green skills"

Erasmus+

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Comparative report about the curricula for electricians on green skills

Project implemented in “Erasmus+” Programme ActionKA2 – Cooperation for Innovation and the exchange of good practices Strategic Partnership for vocational education and training

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CONTENT

Project Description

Climate change is the main environmental policy priority across Member States and Turkey. It is often related to other environmental pressures and policy areas, for example water scarcity and energy. Public policies and enterprise strategies in many areas focus on greener economics. Countries take into account environment when they are preparing their legislation etc. Although all Member States and Turkey recognise the importance of environment in general policy statements, the skills dimension of climate change and low-carbon policies is disregarded. In fact green skills for different occupations plays a crucial role in having an eco-friendly world.

The project aims to analyse and make some positive changes for greener economics by contributing the Vocational Education by identifying the needs of partner countries on green skills for construction and electric sectors.

The expected results of the project are:

- contribution to the protection of environment in long term in partner countries.
- contribution to the expansion of green skill jobs.
- increase in the quality of green skills vocational education and training in partner countries.
- increase of the awareness of policy makers, VET trainers VET students, employers and all communities in partner countries on green skills
- contribution to European Union's green skills strategy
- improvement of the employment opportunities for the workers graduating from partner countries' VET organizations by increasing the awareness of VET systems regarding green skills education for construction and electric sectors.
- share of knowledge about and experiences of the green skills occupation in vocational training for construction and electric sectors.
- A cross-border cooperation among partners in the field of education and employment from different EU countries from different nature (VET, private sector, NGO's) but with common goals related to the potential increase in vocational education.
- The Enhancement of the commitment of local and regional public authorities in the high quality VET offer, labour inclusion by work-based training and the identification of key skills for construction and electric sectors.
- The involvement of participants in this project will improve their capacities in the area of strategic development, organizational management, project management, international cooperation in EU level, leadership, quality of learning provision, equity and inclusion.
- increase in the human resources capacity of partner institutions.

About Report

This comparative report has been developed to determine the need to introduce green skills in curricula and in training contents of vocational education for electric workers in partner countries. Each partner country analysed their vocational education system on electric sector from the aspect of green skills. We scanned the training content on electric vocational education in order to find the information related to green skills and environment in curricula and training contents.

Firstly we developed a framework to be able to have comparible national versions. Each partner developed its national drafts and then we combined them in a final report. (work to combine these

national drafts). We saw that each partner country has totally different VET systems. This makes difficult to compare the systems.

This report is a good start to understand how much the curricula and training contents of partner countries (Turkey, UK, Italy, Spain, Romania) include green skills and environment related issues at electric vocational training.

We compared training content of ISCED 3 level (age 15-17) students at electric sector.

Green Skills in General

Climate change is the main environmental policy priority across EU Member States and Turkey. A significant amount of money has been dedicated to dealing with climate change and moving towards a low carbon economy through national stimulus packages adopted in response to economic crisis. The focus for green stimulus spending tends to be energy efficiency in buildings, renewable energy, low-carbon vehicles and sustainable transport.

Climate change and environmental degradation are jeopardising livelihoods and future sustainability in many areas of economic activity around the world. Alongside other drivers of change such as globalisation and rapid technological change, they are causing important shifts in labour markets and skills needs.

Although all Member States and Turkey recognise the importance of environment in general policy statements, the skills dimension of climate change and low-carbon policies is disregarded. In fact green skills for different occupations plays a crucial role in having an eco-friendly world.

Public policy, together with private initiatives, can foster expansion of green transformation and harness energy efficiency and renewable energy potential, all of which requires transformation of the skills base. Skills development responses need to focus on adding to existing competences, emphasising core skills, for all levels of skill needs. Every job can potentially become greener. Understanding the environmental impact of a job, and its possible contribution to greener economies, needs to be mainstreamed into education and training systems. Integrating sustainable development and environmental issues into existing qualifications and capturing new and emerging skill needs on the greening job market are a massive task.

Green jobs are jobs that reduce the environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable. The ILO defines ‘green jobs’ as work in agriculture, industry, services and administration that contributes to preserving or restoring the quality of the environment while also meeting requirements of decent work: adequate wages, safe conditions, workers’ rights, social dialogue and social protection

General Vocational Education System in Partner Countries

TURKEY:

Purpose and Priorities of Vocational Education

Vocational and technical education aims to train skilled labour force with national and international occupational competence, professional ethics and professional values, innovative, entrepreneurial and productive in cooperation with the social and economic sectors. Vocational and technical education aims to create a system that provides appropriate learning opportunities in line with the interests and abilities of individuals, prepares young people for employment and develops them according to the needs of economic and social sectors.

Priorities of vocational education in Turkey are the following:

- To train qualified labour force in line with the needs,
- To manage vocational and technical education with a participatory approach,
- To ensure that graduates are trained to participate in production,
- To continuously improve the technical and technical education system and improve its quality,
- To prepare modular teaching programs according to the needs of the labour market,
- To ensure the social and sectoral integration of vocational education in order to increase efficiency and competitiveness in the economy,
- To provide individuals with the skills needed to adapt to change as well as knowledge and skills,
- To establish new business areas within the framework of the digital transformation of the sector and gaining entrepreneurship understanding that plays a role in increasing employment.

School Types and Programs

In vocational and technical education, formal and non-formal education is provided in order to enable the students to receive education in accordance with their possibilities. Vocational open education high schools have been established in order to meet the vocational training needs of individuals who have gone out from formal education for some reason or who wish to acquire an alternative profession after compulsory education age. Student enrollment to vocational high schools may vary according to the type of school and the field and branches to be selected. Transitions of students between the school type and the programs and the transfers between the schools can be made under certain conditions. The students are given a diploma according to the school type, program, field and branch they have completed. In 2017-2018 academic year, a total of 5.689.427 students were educated in secondary education. 1.987.282 of these students were in vocational and technical secondary education institutions. The formal education given within the scope of vocational and technical education is carried out in three types of schools: Vocational and Technical Anatolian High Schools, Multi-Program Anatolian High Schools and Vocational Training Centres. Vocational and technical education within the scope of non-formal education is given in Vocational Open Education High Schools. Training periods vary according to school types.

Formal Vocational and Technical Education Schools are as follows:

Vocational and Technical Anatolian High School
Anatolian Vocational Program (AMP)
Anatolian Technical Program (ATP)
Craftsmanship Program (MEMP)

Multi-Program High School
Vocational and Technical Anatolian High School
Anatolian High School
Anatolian Religious High School
Craftsmanship Program (MEMP)
Vocational Training Centres
Craftsmanship Program (MEMP)

Fine Arts High Schools
Sports High Schools

- In the Anatolian Vocational Program there are general knowledge courses as well as knowledge and skills related to a profession.
- In the Anatolian Technical Program, mathematics, physics, chemistry and biology courses are given predominantly for 4 years as well as knowledge and skills related to a profession.
- In both programs, vocational field education in the 10th grade and branch training depending on the profession in the 11th and 12th grade are given.
- Multi-Program Anatolian High Schools; Secondary education institutions which apply general and vocational and technical education programs under an administration.
- Vocational Training Centres are the educational institutions where craftsmanship training and vocational and technical course programs are applied.
- In vocational and technical Anatolian high schools, a curriculum is offered in 54 fields and in 199 branches under these fields.
- In Vocational Education Centres training programs are carried out in 27 fields and 142 branches under these fields.

Non-Formal Vocational and Technical Education Schools

Vocational Open Education High Schools (MAOL): Vocational Open Education High School started to serve face to face education in its programs in 1995 and served until 02.02.2006. On 02.02.2006, "Vocational Open Education High School" participated under the umbrella of the General Directorate of Educational Technologies with the approval of the Ministry.
Vocational Open Education High School is equivalent to the vocational high schools in formal education in terms of program content but it differs from formal education in terms of structure and operation. Education is carried out by distance education, on the other hand graduation is based on passing the course and credit system. In spite of training is given within the scope of non-formal education, vocational courses are often given face to face in formal vocational education institutions in order to develop students' skills. Since 2005-2006 academic year, education in Vocational Open Education High School has been structured as four years. Adult education is also provided in public education Centres. Vocational colleges provide vocational training at universities within the body of YÖK.

Vocational Technical Education Budget:
The total budget allocated for vocational and technical education reached 12.5 billion TL in 2018, compared to 6.32 billion TL in 2013. The MTEK budget per student increased to 7.609 TL in 2018 from 3.916 TL in 2013. The fact that both the total budget allocated and the budget per student reach approximately twice in a six-year period are important in terms of increasing the quality of vocational and technical education and emphasizing its importance.

Fields of Vocational Education:

Vocational and technical education in Turkey, began to be offered in a modular way with the Strengthening Vocational and Technical Education Project (MEGEP) applied since 2005. Currently, vocational training is offered in 54 fields, which are given below.

Justice
Family and Consumer Services
Shoe and Saddlery Technology
Biomedical Device Technologies
Office management
Child Development and Education
Marine
Entertainment Services
Craft Technology
Electrical and Electronics Technology
Industrial Automation Technologies
Journalism
Ship Building
Food Technology
Fashion Design Technologies
Graphics and Photography
Beauty & Hair Care Services
Public Relations and Organization Services
Map / Deed
Patient and Elderly Services
Construction Technology
Firefighting and Fire Safety
Chemical Technology
Accommodation and Travel Services
Jewelry Technology
Labouratory Services
Machine Technology
Printing Technology
Metal Technology
Metallurgical Technology
Furniture and Interior Design
Motor Vehicles Technology
Accounting and Finance
Musical Instrument Making
Marketing and Retail
Plastic Technology
Radio-Television
Rail Systems Technology
Art and Design
Ceramic and Glass Technology
Agriculture
Textile Technology
Plumbing and Air Conditioning
Aircraft Maintenance
Transportation Services
Food and Beverage Services

Internship Practice
Students perform vocational training practices by internship in enterprises. Vocational Training in enterprises is a training model that students take skills training in enterprises and theoretical education in education units established by schools, enterprises or institutions. Anatolian vocational program students in the 12th grade go to skills training in enterprises three days; on the other hand, Vocational Education Centre students go go to skills training four or five days from the 9th grade. Internship is the vocational training which the students of Anatolian technical program develop in their professional knowledge, skills, attitudes and behaviours, to adapt to business life, to grow in real production and service environment, and to work in enterprises for 40 working days in order to enable them to recognize the facility and equipment that are not in school.

Rights Granted to Graduates
All vocational and technical education graduates are given the title of technician. In the transition from vocational and technical secondary education to vocational higher schools, additional score are given to graduates who wish to study in the field according to the results of the university entrance examination.

Some Statistics
In 2017-2018 academic year in Turkey there are 1.642.635 students who continue their formal education in MTEGM -dependent vocational and technical secondary schools. Of the existing students, 864.591 (56.08%) are male and 677.008 (43.92%) are female. 1.541.599 of these students are in Vocational and Technical Anatolian High Schools and 101.036 in Vocational Training Centres. The total number of vocational and technical education institution is 3,636 in Turkey. 2.552 (70.21%) of these institutions are Vocational and Technical Anatolian High School, 762 (20.93%) are Multi Programmed Anatolian High Schools and 322 (8.86%) are Vocational Training Centres. Indicators considered to be important for monitoring the development of vocational and technical education in Turkey is examined under this heading. In this context, the number of students, teachers and schools, revenue assets incomes and employment status of graduates have been examined.

The employment status of the graduates of vocational education between the years 2008 and 2014 provides important information in the fields of graduation and outside of their fields. It is noteworthy that the rate of out-of-field work of vocational education graduates in all fields is higher than the rate of employment in graduation areas. The highest proportion of graduates working outside the field is the Printing Technology (57.20%). The area with a rate of more than 10% graduates working in their field is limited to: Aircraft Maintenance, Marketing and Retail, Labouratory Services and Entertainment Services. The fact that In most occupations, the rate of work in the area of graduation is less than 5%
indicates that they work in jobs that are not directly related to the education they receive. This situation constitutes a significant discrepancy between the vocational skills of graduates and the skills required by their work.

SPAIN:

The current educational system in Spain allows choosing the most appropriate training option for students, the training with which a person accesses the current labor market plays a fundamental role in the possibility of finding a job. But the successful job placement of young people, as well as adults, no longer depends only on their level of education but also on their level of professional competence.
Nowadays, Vocational Training is the professional studies whih are closest to the reality of the labor market and is answering to the need for specialized qualified personnel in the different professional sectors and the current demands for employment.

In Spain, it is offered different proffesional families and inside it, there are different levels:

- Basic Vocational Training Cycles, which lead to the corresponding Basic Professional Degree and it could be compulsory for some students.
- Middle Level Training Cycles, which lead to the Technician's degree and which are part of post-compulsory secondary education.
- Higher Degree Training Cycles, which lead to the title of Superior Technician and it is part of higher education.
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The qualifications obtained during a training cycle have official status and the same academic and professional validity throughout the whole national territory, regardless of whether the studies are carried out in an Autonomous Community or within the scope of the Ministry of Education and Vocational Training.

It is usual that most part of student in VET are located in Middle Level Training courses, above all in the Target Group of this study (15-17). Within the Middle Level Training cycles there are a total of 59 different degrees belonging to 25 families, among which are:

- Physical and sports activities
- Administration and management
- Agrarian
- Graphic arts
- Commerce and marketing
- Building and Civil Works
- Electricity and electronic
- Energy and Water
- Mechanical manufacturing
- Hotel and Tourism
- Image and sound
- Food industries
- Extractive industries
- IT and Communications
- Installation and maintenance
- Wood, Furniture and Cork
- Maritime-Fishing
- Chemistry
- Health
- Security and environment
- Socio-cultural and Community Services
- Textile, Clothing and Leather
- Vehicle Transportation and Maintenance
- Glass and Ceramic

Modalities For The Impartition of Training Cycles

In Spain, there are different modalities of teaching the training modules of each degree:

Face-to-face modality

This modality is studied in educational centers, with regular class attendance. It can be done in the ordinary centers, integrated professional training centers and national reference centers. Beside of that

offer of training cycles, in Spain exists the possibility to do on the job-training, which it is directly in the enterprise, in this case it is better to suit personal and professional situations.

Modality through the Internet (e-learning)

This modality is offered to proffesionals who want to improve their professional qualifications or train for the exercise of other professions and whose social, work or family circumstances prevent or hinder them from undertaking training VET courses in traditional face-to-face mode, this modality offers the possibility of studying with a flexible schedule and with the confidence of having the support and collaboration of teachers, even from your home.

Experience or background

In Spain, there is other alternative to obtain the title of Technician or Superior Technician without having to take the courses of Middle and Higher Level in person or even remotely. This is usually held once a year and are intended for people who already have an important training or background in a certain profession but do not have still the degree, and they are able to prove it presenting itself to a single test (theoretical and / or practical) of each professional module that composes a formative cycle.

Requirements For Being Accepted in a Mıddle Grade Training Cycle in Spaın

Only is necessary to accomplish one of the following:

- Be in possession of a Basic Professional Degree (Basic Vocational Training).
- Be in possession of a Technician or Auxiliary Technician degree or equivalent for academic purposes.
- Have passed the second course of the Unified and Multivalent Baccalaureate
- Have passed the entrance exam to medium-level training cycles (it will be required to be at least seventeen years old, completed in the year of the test).
- Having passed the entrance exam to the University for over 25 years

About the entrance exam to medium-level training cycles, it is organized by each Autonomous Community and, in case that the student passes, the participant will be able to study any medium-level training cycle around the national territory.

The reference curriculum for the organization of this test is focused on the core competencies of Compulsory Secondary Education which are supossed to enable a student to be trained in a mid-level vocational training cycles.

Traıining In Work Centers

It has to be stressed that in Spain, in VET studies there are a compulsory professional module which is called Training in Working centers, and this is a practical training phase inside a company that takes place in professional workplaces and once all the professional modules of the training cycle have been passed, in fact, this is performed in the real environment of the company with real tasks.

The students in this professional module of Training in Work Centers (FCT) does not have an employment or internship relationship, for that, the students who are doing this period are keeping the status of enrolled students in regulated VET education.

In the Degrees of Middle and Superior Grade adapted to the Organic Law of Education (LOE), the length of the professional module of Training in Work Centers will always be up 400 hours. This practices take place in the last semester of the second training year, generally between March and June.

UK

Education in the UK

The United Kingdom of Great Britain and Northern Ireland (UK) is a sovereign state comprised of four countries: England, Scotland, and Wales (Great Britain), and Northern Ireland. The UK Parliament is the supreme legislative body of the UK, but various levels of power are devolved to the individual national administrations of Scotland, Wales and Northern Ireland. As a devolved matter, the governments of the UK administer their own education and training systems, leading to similarities and differences between each country.

Compulsory Education

In England, education is compulsory between ages 5 to 18. At age 16, a learner may alternatively start an apprenticeship or traineeship or spend 20 hours or more week working or volunteering whilst in part-time education or training. In Scotland and Wales, education is compulsory between ages 5 to 16, and in Northern Ireland ages 4 to 16.

Pre-school education is not compulsory, but each government of the UK provides programmes to offer free or part-time nursery or other early years education provision.

Across all countries of the UK, students typically attend a form of early years schooling or nursery to age 4, primary school from ages 4 to 11 and secondary school from ages 11-16. Students may attend a sixth form or college between the ages of 16 and 18, and may attend universities from age 18.

Structure

In England, Wales and Northern Ireland the UK, the compulsory stages of education are referred to as 'Key Stages':

- Key Stage 1: Ages 5-7 (Primary School). Ends in examination by government.
- Key Stage 2: Ages 7-11 (Primary School). Ends in examination by government.
- Key Stage 3: Ages 11-13 (Secondary School). No examinations.
- Key Stage 4: Ages 14-16 (Secondary School). Examinations by Examining Bodies in both years.

Schools are organised into year groups. In England, Wales and Northern Ireland, Primary School runs from Reception to Year 6 and Secondary School runs from Year 7 to Year 13. Years 12 and 13 (Post-16) are also called Sixth Form. In Scotland, Primary School runs from P1 to P7 and Secondary School runs from S1 to S6.

After taking national qualification exams in both years of Key Stage 4 (S4 and S5 in Scotland), students start work or enter 'Further Education' (FE): studying for qualifications at their secondary school's Sixth Form (S6 in Scotland), attending a Further Education, Sixth Form, or Specialist College, or undertake a traineeship or apprenticeship. University education, accessible from age 18, is known as Higher Education (HE).

Curriculums

There are three sources of curriculum in the UK: national curriculums, private curriculums, and Awarding Organisation (AO) curriculums.

National Curriculum

The devolved governments and associated public bodies of each country of the UK devise a national curriculum which informs the programme of study and attainment targets for all four Key Stages – i.e. ages 5 to 16.

Private curriculums

Some types of school, such as academies and private schools, do not have to follow the national curriculum. Such schools devise their own curriculums, but pay Examining Bodies to examine and award qualifications.

Awarding Organisations

Private companies called Awarding Organisations (AOs) set curriculums for post-16 qualifications, including 'vocational' qualifications, developing courses under the guidance of Skills Sector Councils, businesses, and other advisory bodies. Awarding Organisations also provide examination services for Key Stage 4 and for post-16 qualifications.

Funding

The governments of the UK each set their own funding budget for education. In England, for example, the schools budget for 2017/18 was approximately £39billion – 12% of total public spending for the year (UK Government, 2017).

Compulsory education is available for freely available to all, however some parents choose to send their children to fee-charging schools. Access to post-16 learning provision is usually dependent on a student's grades at Key Stage 4. Many courses are offered free for under-24s studying for their first qualifications. Courses for returning learners or those in employment may be undertaken for a fee. There is a range of funding available for all learners to cover potential course costs, living costs and childcare.

Examinations and Qualifications

At Primary School level, each devolved government is responsible for examining students in numeracy and literacy. In England, Wales and Northern Ireland, students take standard attainment tests (SATs) at the end of Key Stage 1 and Key Stage 2. There are no examinations during Key Stage 3. In Scotland, as of 2017, students take Scottish National Standardised Assessments (SNSAs) at P1, P4, P7 and S3.

At Secondary Education level, the national qualifications are GCSEs (14-16) in England, Wales, and Northern Ireland, and Nationals (14-16) in Scotland. These qualifications are examined by five Examination Boards in England, Wales and Northern Ireland, and one board in Scotland[1].

Post-16, students may study 'A-Levels' at their school's Sixth Form or Sixth Form College in England, Wales and Northern Ireland. In Scotland, students study 'Highers' in their 5th year at secondary school, and 'Advanced Highers' in their 6th – two years collectively called S6. These qualifications are broadly intended for learners seeking to attend university and are also examined by the Examination Boards.

All other Post-16 qualifications are examined, awarded and developed by Awarding Organisations (AOs). As AOs set the curriculum, examine students and award qualifications at the post-16 level, they play an important role in the 'vocational' education system of the UK.

Summary Table

Age	Education provider	Key stage	Examiner	Awarding Body	Level	Compulsory?
Pre-5	Nursery		None	None	Early Years	No
4 – 5	Primary School		None	None	Primary (Reception)	No (En,Sc,Wa) Yes (NI)
5 – 7	Primary School	1	Government	None	Primary (Infant)	Yes
7 – 11	Primary School	2	Government	None	Primary (Junior)	Yes
11 – 14	Secondary School	3	None	None	Secondary	Yes
14 – 16	Secondary School	4	Examining Board	Awarding Organisation	Secondary	Yes
16 – 18	Further Education College/Sixth Form College/ Apprenticeships		Awarding Organisation	Awarding Organisation	Further Education (FE)	No (Wa, NI, Sc) Yes (En)
18+	University		University	University	Higher Education (HE)	No

Table Summary of General Education System in the UK Source: UK Government (2012, 2018c), DfE (2018), British Council (2015)

The Vocational Education System in the UK

The UK has never adopted an official definition of 'vocational education' (Wolf, 2011). The term is used differently depending on context, but generally refers to qualifications an[1]d apprenticeships 'providing practical skills that are directly aligned to employment' (DfE, 2017). Other definitions offered specify that vocational educations are 'designed for initial entry to an occupation' (UKCES, 2013).

As such, 'vocational' education in the UK refers to a broad range of:

- *Ages*: vocational may commonly refer to Further Education (FE) provision for 16-18 year olds outside of school, but can be equally applied to practical skills, training and qualifications delivered to all ages;
- *Levels*: from new-comers to a profession to advanced skills;
- *Providers*: from further education institutes to employers;
- *Location*: in a college, workplace or both;
- *Specificity*: from highly specific to the skills need of an occupation to 'vocationally-related' or 'pre-vocational'. (Wolf, 2011)

Whilst often seen in contrast to 'academic' education, vocational education can also prepare learners to 're-enter' academic pathways (DfE, 2017).

Recently, across the UK, the term 'technical education' or 'technical and professional education' is being used more frequently than 'vocational education' (Doel, 2018). Technical education was defined as 'the

acquisition of both a substantial body of technical knowledge and a set of skills valued by industry' (BIS and DfE, 2016). A new landscape for work-based learning, including apprenticeships and vocational learning under 'T-Level' qualification will be launched in England in 2020 (DfE, 2018a).

Structure and Governance

There is a complex institutional framework responsible for education policy and provision across the four countries of the UK. Crucially, independent companies known as Awarding Organisations (AOs) design, develop and deliver qualifications rather than the government. Learning providers subsequently buy the rights to deliver AO-created qualifications at their institution or company (DfE, 2017). A range of governmental bodies regulate AOs, inspect education provision, and manage qualification frameworks on which to define the level of each qualification. Currently, there are approximately 160 AOs in England (ibid.).

The following table summarises the main bodies for each UK country Source: CEDEFOP (2014)

Country	**Governmental department for Education**	**Qualification framework**	**AO/Qualification Regulation**	**Learning Provision Inspection/ Regulation**
England	Department for Education (DfE)	Qualifications and Credit Framework(CQF) maintained by Ofqual	Ofqual	Ofsted (Office for Standards in Education, Children's Services and Skills)
Scotland	Education Scotland	Scottish Credit and Qualifications Framework (SCQF) maintained by the SCQF Partnership	SQA Accreditation	Education Scotland
Wales	Department for Education and Skills	Credit and Qualifications Framework Wales (CQFW) maintained by the Welsh Government	Qualifications Wales	Estyn
Northern Ireland	Department of Education (DE)	Qualifications and Credit Framework(CQF) maintained by the Council for the Curriculum, Examinations and Assessment (CCEA)	Council for the Curriculum, Examinations and Assessment (CCEA)	Education Training Inspectorate

Table Bodies with responsibility for education across the UK

Awarding Organisations (AOs)

Awarding Organisations develop curriculums, examinations, provide training for teachers and oversee quality assurance. This package of services is purchased by learning providers to teach and award their

students. In England and Northern Ireland, 163 AOs supply around 25,000 regulated qualifications (vocational and academic). Near 8.4 million certificates are awarded annually, but the largest 10 AOs award 70% of all certificates issued (DfE, 2017). In Wales, 106 AOs are recognised by the regulating body (Qualifications Wales, 2018), and 39 in Scotland (SQA, 2018a).

Vocational Education Provision

Vocational education generally refers to qualifications offered at upper secondary level onwards (14+) and can be delivered in two manners: college-based or employer-based (DfE, 2017).

College-based provision refers to taught courses and exams outside of employment, at providers which include:

- *Further education colleges*
- *Sixth Form Colleges* (focus is usually on non-'vocational' courses or courses designed to prepare students for degree-level, such as A-Levels and Highers)
- *Sixth Forms within schools*
- *Specialist Colleges* (for studies such as agriculture or performing arts)
- Private sector training centres (which may receive public funding).

	England	**Wales**	**Northern Ireland**	**Scotland**
Further Education Colleges	235	13	6	27
Sixth Form Colleges	90	1	0	0

Figure Number of Further Education Colleges in each country of the UK Source: DfE (2018a)

Employer-based provision refers to qualifications earned whilst working, and include:

- *apprenticeships*
- *on-the-job training*
- courses with some college-based provision, but undertaken whilst being employed in the role being trained for.

Awarding Organisations also organise course planning, training events and exam guidance to provide teachers the additional resources needed to teach their qualifications.

Apprenticeships

In England, Wales and Northern Ireland, apprenticeships are offered at four different levels: Intermediate, Advanced, Higher and Degree. Apprenticeships are available to those over 16 and provide an apprenticeship minimum wage and on-the-job training from the employer (UK Government, 2018a). In Scotland, apprenticeships are offered at: Modern, Foundation, Higher, Graduate and Professional levels (SCQF, 2018). The UK also offers traineeships – courses with work experiences that last up to 6 months, designed to prepare the learner for work or an apprenticeship.

Vocational Education Users

As the UK has no formal definition for 'vocational education', the following data refers to the Further Education sector – the provision of qualifications and apprenticeships outside of schools and school sixth forms. These institutions also provide 'non-vocational' courses, qualifications (e.g. A- Levels/Highers) and excludes non-governmentally regulated vocational education provided by employers.

The following table shows the number of further education students in the UK, per country, as of November 2018, as well as the percentage of learners under 19 – the target group of learners for this project.

	England	Wales	Northern Ireland	Scotland	All UK
Under 19	1,071,700	49,600	74,600	105,900	1,301,800
All Ages	3,157,800	136,200	117,500	233,200	3,644,700
Percentage under 19	34%	36%	63%	45%	36%
Approximate percentage of population under 19 in Further Education[5]	32.0%	24.9%	59.1%	31.9%	36.9%

Table: Students in Further Education by country Source: DfE (2018a)

The following table demonstrates the gender for all students in further education. Across the UK, there are slightly more females in further education than males.

	England	Wales	Northern Ireland	Scotland	All UK
Female	54.6%	55.0%	47.0%	49.6%	52.2%
Male	45.4%	45.0%	53.0%	50.8%	47.8%

Table: Students in Further Education by gender Source: UK Government (2018a; 2018b), Welsh Government (2018a; 2018b), (DoENI, 2018a; 2018b), SFC (2017)

The final table shows students in further education with learning difficulties or other disability.

England	Wales	Northern Ireland	Scotland	All UK
17.9%	10.1%	17%	Unavailable[8]	15%

Table: Students in Further Education with learning difficulties and/or disabilities by country

For Apprenticeships, 72,300 people aged under 19 years commenced internships in the 2017/2018 academic year. In Wales, there were 16,250 apprenticeships started for the same period and age, plus 7,951 in Northern Ireland (Welsh Government, 2018a; (DoENI, 2018c). In Scotland, there were 6,321 new starts for Modern Apprenticeships amongst 16- 19 year olds for the second quarter of the 2018/19 year (SDS, 2018).

Number of qualifications exceeds number of users, as most students will study more than one course or achieve more than qualification from work-based training. For example, in England for the period October 2017-2018, a total of 5,754,900 qualifications were awarded across all subjects and age groups (Ofqual, 2018).

Qualification Levels

National qualification frameworks define the level of a qualification, their credit values and provide comparison between each. Currently, these are:

- the Regulated Qualifications Framework (RQF) regulated by Ofqual in England and the Council for the Curriculum, Examinations and Assessment (CCEA) in Northern Ireland;
- the Credit and Qualifications Framework for Wales (CQFW)
- the Scottish Credit and Qualifications Framework (SCQF)

The RQF and CQFW use the same levels, running from Entry Level (which is further sub-divided into Entry Level 1, 2, and 3) and Levels 1 – 8. In Scotland, the SCQF runs from Levels 1 – 12.

RQF (Eng/NI) and CQF W (Wal)	**SCQF (Sco)**	**EQF**
Entry Level 1	1	1
Entry Level 2	2	
Entry Level 3	3	
1	4	2
2	5	3
3	6	4
4	7	5
5	8	
6	9	6
	10	
7	11	7
8	12	8

Table: Comparison of qualification levels as per all UK and European Frameworks Source: UK Government (2018d); CQFW (2018); SQA (2018b); SCQF (2018)

Several types of qualifications are available for each level. Not viewed as 'vocational' in the sense of leading directly to an occupation, GCSEs and Nationals (in Scotland) are the national qualifications taken at age 15/16. A-Levels and Highers (in Scotland) taken at age 17/18 are often viewed as pathways to university courses. Types of 'vocational qualification include BTECs, diplomas, and certificates. A full list of the types of qualification relating to the target group is as follows:

England, Wales, and Northern Ireland			**Scotland**	
ISCED 3/ EQF 3	RQF/CQFW Level 2	GCSE – Grades 4-9 or A*-C *Intermediate apprenticeship* *Level 2 award* *Level 2 certificate* *Level 2 diploma* *Level 2 ESOL* *Level 2 essential skills* *Level 2 functional skills* *Level 2 national certificate* *Level 2 national diploma* *Level 2 NVQ* Welsh Baccalaureate National	SCQF Level 5	National 5 Level 5 SQA Award Skills for Work National 5 *Level 5 National Certificate* *Level 5 National Progression Award* *Level 5 Modern Apprenticeship* *Level 5 SVQ*

Table: Qualification types available at project target level

Non-regulated Qualifications

Awarding Organisations design qualifications to be placed on the abovementioned national qualification frameworks. Some AOs or employers may offer 'non-regulated' qualifications that are not recognised by the regulated frameworks. Delivering non-regulated qualifications is not illegal, but cannot be used to deliver vocational training, but may be necessary in situations where learners 'have learning difficulties or disabilities, are unemployed and actively seeking work, or need smaller packages of tailored support to re-engage with learning' (SFA, 2015).

Credits

Units within qualifications are worth credits. A learner must complete a number of mandatory and optional units in order to reach the credit requirement to earn the qualification. A student may take certain optional units in order to specialise in particular skill to an occupation, often called a pathway. In some circumstances, the Joint Council for Qualifications (JCQ) and the regulator can arrange credits to be transferred.

Current Issues in Vocational Education

A review of adult vocational qualifications in England (UKCES 2013), identified key issues with the vocational education system as a whole, including:

- Awarding organisations are not expected to provide information about the value added by their qualifications
- Awarding organisations are not expected to be consistent in their approach, compared to other awarding organisations
- Vocational qualifications having no consistent design
- Little emphasis on economically useful skills
- Confusing titles and databases for qualifications
- Teachers untrained in new technologies for delivering education
- Limited employer involvement in creation of courses (2013: 16-20)

After the review, qualifications were streamlined and made easier to navigate and established that qualifications should be 'relevant, rigorous and recognised'. In 2017, a government consultation which looked at the changed vocational education landscape after the Whitehead review found issues remained:

- The importance of passing inspections has led institutions to offer more qualifications that are 'easier to pass', causing a 'race to the bottom situation'
- Insufficient content regulation – including lack of regulation for curriculum content.
- Small training institutes lacking tools and resources
- Smaller employer's needs less likely to be represented in course content. (DfE, 2017)

The vocational education system is on the edge of an overhaul, with new 'T-Level' qualifications scheduled to launch in 2020. The invitation for AOs to tender to develop the courses commences imminently (Spring 2019) (DfE, 2018b)

ITALY

In Italy all young people have to attend the school until reaching the age of majority (18 years old) and to perform a total of 10 years of compulsory schooling in wich two years of an education and professional training are planned.

In Italy, the first cycle of education ends at the age of 14 and it is validated through an exam and the issue of a certificate for admission to the second cycle of education. In this second cycle the students have the possibility to choose between a general education or an education and training path. Within this second cycle, young people can choose different solutions:

- high school education;
- technical education;
- professional education;
- vocational education and training programs organized by the regions;
- apprenticeship for qualification and professional diploma (after having completed 15 years of age);

Education and vocational training (VET)
In Italy, the term vocational education and training identifies specific paths that are formulated by the regions and the autonomous provinces. Vocational education and training is available at secondary, post-secondary or higher levels in formal or non-formal education and training. VET is aimed at young people and adults and can be provided by a school or by a public or private company or body. VET in Italy also includes technical and professional institutions.

In planning the course structure, the actors involved have different responsibilities:

- The Ministry of Education, University and Research defines the framework of VET in national school curricula;
- The Ministry of Labor and Social Policies defines the framework for vocational education and training, while its planning, organization and provision is delegated to the regions and autonomous provinces.

Specifically, the objectives of continuing vocational training provided within the public system are set by the Ministry of Labor, while the activities of continuing vocational training are managed by the autonomous regions and provinces or by the social partners. The social partners generally play a consultative role in the formulation of VET policies and contribute to their translation into the paths that make up the training offer.

Technical and professional training courses
The programs offered by the technical institutes provide knowledge, skills and competences for the performance of technical and administrative professions, while those of the Professional institutes provide both theoretical and practical preparation for the accomplishment of qualified professional roles in productive sectors of national interest. Graduates have access to higher education and acquire a 4th level qualification of the European Qualifications Framework (EQF). The certificates issued to test the acquired skills are drafted by the Ministry of Education and formulated in four Community languages, in order to be included in the various Member States.

The three-year and four-year courses of VET
The three-year and four-year vocational education and training courses are organized by the regions but funded by the Ministry of Labor. Currently, four-year professional courses are not offered uniformly throughout the country. These paths are structured in modules and aim to develop basic, transversal and technical-professional skills. The articulation in modules allows students to change the area of study thanks to the recognition of credits. It is important within these courses, the supervision of two tutors: one

related to the trainer, the other to the enterprise.

Post-secondary high school technical training
These paths aim to deepen the specialization at post-secondary level to meet the needs of the labor market in the public and private sectors. These are planned and organized by the regions and the autonomous provinces on the basis of territorial plans adopted every three years and their offer are different from region to region. These courses are divided into:

Higher Technical Education and Training courses: divided into 20 specialization areas at national level. However, each specialization is described according to the demands of the local job market. These courses include a mandatory internship is considered very important. The Advanced Technical Education and Training paths are planned by the regions and are designed and managed by at least four training subjects: a school, a vocational training center, a university and a company.

P***athways realized within the Higher Technical Institutes:*** these courses offer nonacademic opportunities at a higher level for a total of 29 national professional profiles. The routes form technicians specialized in six technological areas considered strategic for the development of the country. Young people and adults may be admitted as long as they hold a certificate of upper secondary school and 50% of the training must be provided by subjects from the real job world and professions.

Furthermore, the Higher Technical Institutes act as foundations for participation that must involve the following subjects:

- a secondary, private or public educational establishment which belongs to a technical or professional association;
- a training agency accredited by the region for higher education;
- an enterprise of one of the productive sectors referred to by the higher technical institute;
- a university department or other body belonging to the scientific and technological research system;
- a local authority.

Post-VET paths and much more
Those who have completed a training in three- or four-year and those who have completed a second-level secondary school can access the vocational courses developed by the regions or autonomous provinces. These are courses lasting 400-600 hours and they are co-financed by the European Social Fund (ESF). A certificate of professional training is issued, ie a second level qualification, at the end of the course.

The courses provide theoretical, technical and managerial knowledge but also include workshops and practical work and the achievement of a mandatory internship. Admission enters through selection procedures with a knowledge assessment through an interview. To start the courses it is necessary to reach a suitable number of students and the teachers selected are based on this number.

The courses are divided into modules or units for thematic groups or acquisition of specific skills. Timetables are established at regional and local level and subsequently defined by the vocational training center that provides the course: lessons can be concentrated in a few weeks or be distributed throughout the year. Course management is decentralized and general information on curriculum contents is not available at national level. The acquisition of skills is generally monitored with intermediate evaluations through an examination or presentation by the student. There is a final exam that can be written, oral or practical, and for the admission to this examination it is necessary to have attended at least 2/3 of the course. The courses are managed by the vocational training centers accredited by the regions and are not uniformly distributed throughout the territory. The courses conclude with a qualification certificate issued by the regions on the basis of their specific register and these certificates are not recognized at national level. There is still no national register of qualifications achievable with regional courses.

Postgraduate education and training
Those who have completed a degree course can access postgraduate specialization courses in a specific field. These are organized by the regions and by the autonomous provinces and have a duration of between 400 and 600 hours. These courses provide participants with a regional qualification that corresponds to specific professional areas not included in the national qualification registry.

The apprenticeship
In Italy, the apprenticeship is a work contract for training and employment. This includes both on-site and classroom training. The apprenticeship contract, which differs from other forms of work-based learning, must be in writing. The roles and responsibilities of all the parties are defined in it. The apprenticeship system in Italy includes three types of contracts:

Apprenticeship for the qualification and the school leaving professional certificates: it is aimed at young people aged between 15 and 25 years. There are no specific requirements for admission to these courses. Furthermore, the apprenticeship is governed by the regions and the autonomous provinces through specific agreements signed in the State-Region conference. The contents, divided into theoretical and practical learning, the specific qualifications offered and the number of training hours,
are established by the regions and the autonomous provinces in accordance with the minimum standards agreed at national level. The duration of the contract is determined according to the certificate or diploma obtained. These apprenticeships last from three to four years and allow to acquire an operator or technical qualification respectively in 22 and 21 professional fields. The professional qualification certificate can be obtained (level 3 of the EQF) or professional technical diploma (level 4 of the EQF). These qualifications are present in the national qualification registry.

Professional apprenticeship or professional contract*:* it is aimed at young people between the ages of 18 and 29 who want to acquire a qualification included in the collective agreements and required by the labor market.

Apprenticeship of high training and research*:* This apprenticeship is aimed at obtaining qualifications of various levels and includes qualifications ranging from level 4 to level 8 of the EQF and is aimed at young people aged 18-29.

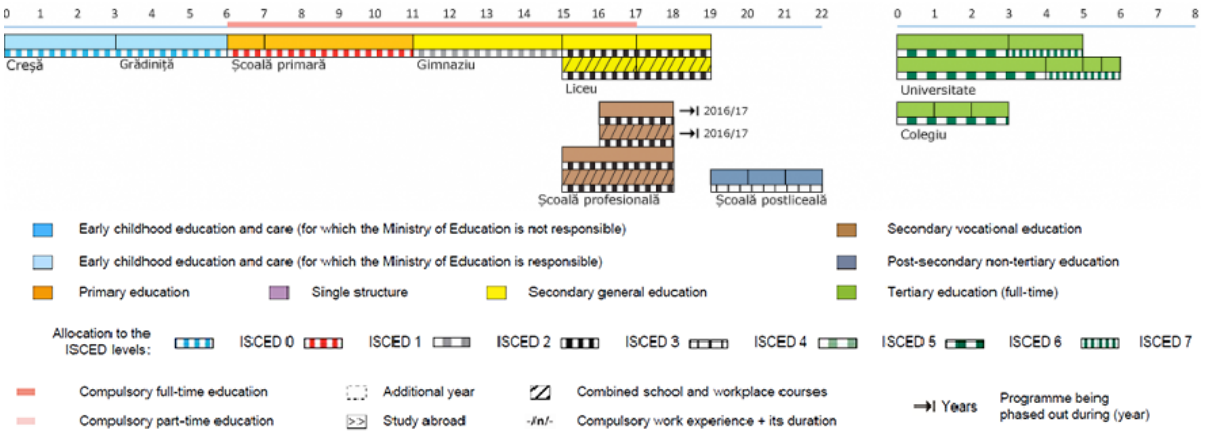
ROMANIA

Romania's education system is centralized, both horizontally and vertically. All key responsibilities for education strategy, policy and delivery are concentrated within the Ministry of National Education (MNE). Several specialized bodies provide input to the ministry, but there is no fully independent evaluation body. Locally elected authorities play very little role in the design and delivery of education policies. The MNE directly steers and monitors the implementation of national policies at the local level through the County School Inspectorates (CSIs).

Responsibility for education is concentrated in central government. The MNE is responsible for setting the education system's overall strategy and national policies, from pre-school and compulsory education to vocational education and training and higher education. In the pre-university system, it is responsible for approving and monitoring the implementation of the curriculum, managing the school network, and allocating financial and human resources to schools. The MNE is also responsible for the national system of evaluation, with implementation and some policy evaluation performed by public bodies linked to the ministry.

Source: oecd reviews of evaluation and assessment in education: romania 2017

The Romanian education system has the following structure:



source: Eurydice 2016

Pre-university education:

a) Early education (0-5 years), consisting of the ante-pre-school level (0-2 years) and pre-school education (3-5 years);

b) Primary education (6-10 years) (5 Grades: Preparatory Grade up to Grade IV)

c) Secondary education, which includes:

1.Lower secondary education 11-14 years (4 Grades: Grade V up to Grade VIII)

Upper secondary education:

15-18 years, which may be:

- High school education, comprising high school Grades IX-XII / XIII, with the following branches: theoretical line with the humanist and real profiles, "vocational" branch, with military, theological, sports, artistic and pedagogical profiles and technological line with technical profiles, services, natural resources and environmental protection;

- Professional (Vocational)[2] education, comprising professional schools Grades IX-XI, that may be independent or affiliated units to technology high schools;

Non-tertiary tertiary education, which includes post-secondary education

Note: In Romanian education system, "Vocational" refers to the military, theological, sports, artistic and pedagogical high schools profiles. In order to not create confusion, for VET, we will use the terminology of Professional and technical education instead of Vocational and technical education.

University education:

a) Higher education Bachelor degrees

b) Higher education Master

c) Higher education Doctoral studies

General information about the Romanian initial professional and technical education (iVET)

The initial professional and technical education (iVET) in Romania refers to professional education with an important component of work based learning and consists of:
a)professional education,
b)technological high school education
c)post-secondary education.

Currently, the iVET system in Romania is focused on the specific qualifications and practical skills and deepening the key competences to the real work and offers qualifications at four levels:
-- Qualifications at NQF/EQF level 2 for graduates of 2 years professional education;
- Qualifications at NQF/EQF level 3 for graduates of 3 years of professional education;
- Qualifications at NQF/EQF level 4 for graduates of upper secondary education (technological high schools);
- Qualifications at NQF/EQF level 5 for graduates of post-secondary education (VET postsecondary school).

The initial professional and technical (iVET) education graduates who pass the professional qualification certification exam, acquire a professional qualification certificate for level ~~2,~~ 3, 4 or 5, according to the National Qualifications Framework, and the descriptive supplement, according to the Europass.

The initial professional and technical education (iVET) can be organized for qualifications in the National Register of Qualifications, updated periodically, according to the needs of the labor market identified by strategic planning documents of the regional, county and local training offer.

The initial professional and technical education (iVET) may also be organized on the basis of requests from private employers or from the National Agency for Employment, based on tuition contracts.

The iVET National Curriculum shall be based on Professional Training Standards approved by order of the Minister of National Education, at the proposal of the National Center of Education Development of Vocational and Technical Education, and elaborated in consultation with the social partners.

The Professional Training Standards are based on Occupational Standards approved by National Authority for Qualifications.

The National Centre for Technical Vocational Education and Training Development was created in 1999 and is accountable to the MNE. It develops the qualifications and the national curriculum for initial professional and technical education (iVET) in upper and post-secondary education, according to the National Qualifications Framework.

In initial professional and technical education (iVET) apply the National Curriculum, developed in accordance with the needs specific to personal development and the needs of the labor market and of each community, based on the principle of subsidiarity.

Based on the National Education Law issued in 2011, schools in Romania have some autonomy over the curriculum: the National Curriculum contains compulsory disciplines / modules and fields study that represent 2/3 of the total number of training hours and optional disciplines / modules at the school's decision (that represent 1/3).

For the initial professional and technical education (iVET), the curriculum at the school's decision is a local development curriculum and constitutes the educational offer at the local level, developed by the school in partnership with the economic organization / local public administration, with the approval of the County School Inspectorate. In this way the iVET education is adapted to the local needs of the labor market.

General information of VET programmes for target groups at electric training.

TURKEY

Electric is a sector that is related to several fields including, construction. Machines, infrastructure etc... It has a production dimension and implementation dimension. Implementation companies act in each part of Turkey, production of electrical machines and electric component companies are mostly at Marmara, Central Anatolia and Aegean regions. Production of electrical machines and components sector has more than 40.000 employment (http://www.sasad.org.tr/uploaded/elektrik-ve-elektronik-yp-16012013113219.pdf) While the electric-electronics field affects many areas, it also contributes to the economy at its own filed and also by second-degree contributions to other sectors. This means that technology changes and quality increases in this field will have a positive effect on the increase of quality in many sectors that use sector products as inputs.

Branchs at Electric Electronic Technology Vocational Education are:
winding,
Office Machines Technical Service,
Electrical Installations and Panel Installer,
Technical Services,
Electromechanical Carriers Maintenance and Repair,
Industrial Maintenance,
Video and Audio Systems,
Security systems,
Communication Systems,
High Voltage Systems

Electric electronic Technologies is one of the 54 fields in vocational education system in Turkey. Only 2,85 of of the electric-electronic technology students are females, 97,15 of them are males. Only 9,3 % of the electric-electronic graduates are working at their sector. 44,83% them are working at other sectors. This is one of the main problems of Turkish VET system. Unfortunately low percentage of the graduates work on the sector that they are trained.

Main lessons at electric-electronic technology:
Ac motor control and winding techniques lesson
Network structures lesson
Smart home appliances lesson
Smart home systems course
Alarm and access control systems course
Lift systems course
Printing machines lesson

Computer aided applications course
Multimedia systems course
Distribution panel systems course
Dc motor winding techniques course
Digital electronics course
Electrical machinery and control systems
Electric motors lesson
Electrical-electronics fundamentals
Electrical-electronic technical official course
Electrical-electronic and measurement courses
Electronic systems course
Industrial electrical systems
Industrial control systems course
Industrial control and fault analysis
Energy transport and conservation systems course
Power generation and distribution centres
Faxes lesson
Communication equipment and network infrastructure course
Communication basics course
Home appliances
Closed circuit camera systems course
Protection relays and modular cells lesson
Control techniques lesson
Microcontrollers course
Mobile systems course
Panel design and assembly course
Voice and lighting lesson
Coolers and air conditioners
Television lesson
Cleaning and washing home appliances lesson
Transformer winding course
Building electrical and force facilities
Cash register and money counting machine lesson
Printers lesson
Yg plant maintenance and repair techniques course
Escalator / Road Systems Course
Weak current facilities and electrical installation projects

SPAIN

In Spain, the degree to be in Electrical and Automatic Installations Technician belongs to the Electricity and electronics VET family
The **duration** of the Technician in Electrical and Automatic Installations course is **2000 hours** and it is possible to do it in **488 educational centers** distributed throughout the whole national territory.
The **main objective** of this training is to know how to set and maintain telecommunication infrastructures in buildings, low voltage electrical installations, electrical machines and automated systems.
Through the study of the middle grade, the learning **objectives** in this course are the following:

- Configure facilities and equipment.
- Assemble the component parts of a low voltage distribution networks and auxiliary elements.
- Assemble equipment and conduits associated with electrical and automated installations and telecommunications infrastructures in buildings.
- Install and maintain rotating and static electrical machines.
- Maintain and repair facilities and equipment.
- Establish the logistics associated with assembly and maintenance.
- Prepare budgets, technical and administrative documentation.
- Verify the operation of the installation.

It is included the necessary knowledge necessary to work with safety and information about basic level of labour risk prevention.
The training established in the previous professional modules guarantees the level of knowledge required in the official Installer card in low voltage, both in the Basic and Specialist categories.
The **professional modules of this training cycle**, are offered on a face-to-face basis, and it will be organized in two academic courses. The first academic course is developed entirely in the educational center. In order to be able to take the second course, it would be necessary to have passed, at least, eighty percent of the hours of the first course.

In Spain, this **training** takes place in four different possible places:
1- The **multi-purpose classroom**, where it is usual the audiovisual equipment, computers are located, connection to internet is available...
2- **Automatic systems workshop**, where there are equipment for the assembly of electrical panels, electrical panels, frequency converters ...
3- **Electrotechnical installations workshop**, where machinery, batteries, solar panels are located ...
4- **Technical classroom**, where there are wireless systems, and other tools and devices

At the end, when the students have finished their studies, the professional opportunities are very varied in Spain, among them are the following:

- Electrician installer.
- Construction electrician.
- Industrial electician.
- Electrician of maintenance.
- Technician for the installation and maintenance of domotic systems.
- Professional antenna installer and maintenance
- Telecommunications installer in residential buildings.
- Installer of telephone installations and maintenance.
- Installer of solar photovoltaic installations.

Once the student has finished his training at Middle level, he/she can continue to be trained with:

- Professional specialization courses

- Another cycle of Vocational Training with the possibility of being reduced some modules due to validations of previous studies.
- Pre-university courses
- Preparation for doing the official test to access to the University

UK

Sector Overview

This project focuses on electrical installation within the construction industry. As of 2018, the construction industry provides 2.4 million jobs – 6.8% of all jobs in the UK. The sector is forecast to require an additional 31,600 new recruits annually to 2022, a 3.3% growth (CITB, 2018a). The potential impact of Brexit – the UK's move to exit the European Union – on the sector is yet to be fully comprehended, however CITB reports that more firms are seeing Brexit impacts through 2018, including staff shortages (CITB, 2018b).

The electrical trades and installation sub-sector employs 197,200 people in the UK, and is forecast to require 1,630 new recruits per year to keep up with demand (CITB, 2018a).

The skills needs of UK industries such as construction are assessed by the business-led UK Commission for Employment and skills and a network of industry specific Sector Skills Councils (SSC). The SSC for the construction industry is CITB – the Construction Industry Training Board. The CITB and other skills bodies advise awarding bodies in course content and development and endorse the content of individual modules. Specific to electrical installation, the National Inspection Council for Electrical Installation Contracting (NICEIC) regulates training and provision.

Pathways into Electrical Installation (Construction)

A 2016 CITB survey identifies four main routes into the construction industry for post-16 year olds: apprenticeships, further education study, sixth form study, and starting work.

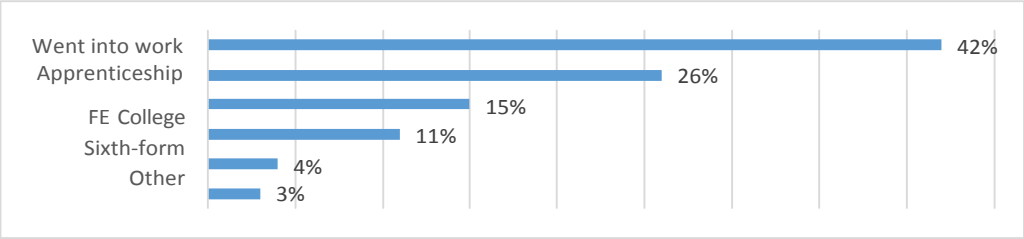


Figure 2 Pathways of workers after compulsory education (CITB, 2016: 11)

Current Issues in Vocational Education particular to Electrician Training

Electrical installation, as part of the general construction industry, is subject to a sector-wide skills need. In 2016, the Construction Leadership Council published a review of the UK Construction Labour Model with a blunt message: 'modernise or die' (Framer, 2016). The review included the urgent need to reform strategy from reactionary to long-term, encourage innovation, and align training to industry need. Similarly in 2015, the Federation of Master Builders (FMB) issued its own analysis, describing the skills need in construction as a 'Time Bomb' (Pye Tait, 2015).

CITB identifies a skills supply gap and a need to 'accelerate the pace of modernisation' (CITB, 2018a). Main causes for the skills gap include:

- Aging work population: 20% of workers are over 50, 15% over 60
- Perception: new entrants put off by the industry's image, or by collapse of large firms such as Carillion – a British construction and support service business which went into liquidation after amassing
  - £1.5bn in debts (BBC, 2018), halting several large projects and causing the redundancy of over 3,000 workers (Scott, 2019).
- Technologically behind: lack of digital or creative options putting off young entrants (Waters, 2017)

A recent review of the vocational education market found that construction qualifications rank, on average, as quite low in terms of responsiveness and innovation (0.6), but high in terms of rigour and qualification recognition (0.25) (DfE, 2017). The review found that construction in particular rated poorly on employer involvement, with only 1-2% of employers involved in course content design and 8-11% noting that qualifications could not be adapted to their business needs (DfE 2017). It is common practice to consult larger firms on content, rather than the needs of small construction businesses (DfE, 2017).

Apprentice Levy

In 2017, the government created a scheme called the Apprenticeship Levy. Employer's wages bills are levied 0.5% to pay for apprenticeships, rather than from taxpayer funds. All companies with payrolls of over £3m are liable to pay the levy. Those contributing may reclaim their contribution as digital vouchers which can only be spent on the training apprenticeships (CITB, 2016a). The scheme has been met with an overall decrease in apprenticeship uptake (UK Government, 2019). Sectoral bodies have called for apprenticeship reform, criticising the inability for larger firms to use vouchers in other areas of training – such as on-site tradespeople – where it is vitally needed (Price and Wales, 2018). The ability to move 25% of digital vouchers across the supply chain will be introduced in April 2019, and the scheme is in review (Gerrard, 2018).

Green Skills Content in Vocational Education

Background

Green skill content in vocational education for electricians as part of the construction sector in general has developed steadily but has been marred by a lack of collaboration between interested parties: the complex network of devolved government bodies for education and for skills, sector skills councils, businesses and awarding organisations.

In 2011, the UK government's report on 'Skills for a green economy' identified the skills required for sectors, including construction, to enable a transition to a green economy. For construction, the report identified additional skill requirements for:

- New building standards such as BREEAM
- New management systems
- Sustainable methods
- Environmental targets
- Ecosystem services design
- Carbon and water foot printing (UK Government, 2011)

The Learning and Skills Improvement Service (LSIS) was established to improve green skills provision across the sector, however the service was closed in the 2013.

The Green Deal

Creation and withdrawal of environmental policy has also stifled green skills in vocational education, with providers unsure of which skills will continue to be promoted. A primary example is the government's flagship 'Green Deal' policy. Announced in 2013, the Green Deal would allow consumers to

pay for 45 types of energy efficient home improvements through the savings made to their lower energy bills. It was hoped that £400m in savings across 14m homes could've been created (Guardian, 2016). Preparation for the Green Deal involved a detailed review of skills gaps (Pye Tait, 2012), from which a Green Deal Competency Framework (GSA, 2013) was created – linking the needed job roles to national occupational standards, qualifications and apprenticeships routes. The framework intended to guide skills in terms of future market demand. In terms of electrical installation, the report identified the need for the following Green Deal knowledge requirement for traditional roles, including electricians:

- to understand the impact of their work on energy efficiency measures and vice versa;
- to identify potential business opportunities arising from refurbishment projects;
- to inform whether a need to demolish and rebuild (Pye Tait, 2012: 39)

However, Green Deal funding was pulled in 2015 after only 1% of households took up the scheme (Guardian, 2016). Prior to its inception, construction industry figures pointed to a lack of incentives to enter into the Deal (Nichols, 2011) and poor marketing (CPA, 2014).

Current Policy

The terminology around the construction industry is changing. Rather than 'building' and 'construction', the Farmer Review advocates for 'built environment', 'built asset creation' and 'construction integrated manufacturing'. Rather than 'green skills', the term '*modern* methods of construction' has taken precedent (Rhodes, 2019).

Modern methods include technologically upskilling the workforce – including ensuring digital competencies are embedded in qualifications – which may require electricians to better understand digital wiring and the 'Internet of Things' (CITB, 2018c).

A coherent approach to green skills within vocational provision would require cooperative policy from many arms of government: education, skills and climate, as well as the guidance of sector skills councils, businesses, the demands of the current market, and awarding organisations.

ITALY

In Italy, for the three-year and four-year courses of VET, there are no national study programs divided by subject, because each individual region are responsable of them.

The provision of VET, an alternative to the scholastic one, is divided into two macro-typologies: pathways owned by training agencies accredited by the Regions and interventions by educational institutions in integration with the training agencies. In this case the schools follow the guidelines of the individual regions for the realization of these paths.

To plan and carry out the training intervention, the structures prepare a didactic project, based on the analysis of the tasks and skills characterizing the professional objective of the intervention. It is widespread the design of interventions for articulated modules attributable to the basic, transversal and technical-professional skills.

Regarding key competences, the reference for the development of the curricula for the first two years of compulsory education is the document on key competences for the citizen, within which the basic skills for the 3rd and 4th years, useful for the subsequent didactic planning, are contained in the Agreement of 27 July 2011 and refer to the areas of linguistic, mathematical, scientific-technological and historical-socio-economic competence.

Regarding the programming of the training objectives related to the professional aspect, the reference

goes to the technical-professional standards for the 22 professional figures leaving the three-year courses and for 21 of the four-year courses. These standards are organized around work / activity processes and skills required by the professional figure. Furthermore the skills are articulated in skills and knowledge.

An example of a VET program concerning the electrician work can be described below.
This program was drawn up after contacting the Padua Constraction school. For years active in the construction sector, with a historical background in the training both of constraction operators and electrical operators.

In Italy, the Electrical Operator three-years course, aims to form one professional figure able to realize and operate on plants, specialized installation and repair of electrical systems, lighting systems, ringtones, video monitoring and domestic appliances installation.
The learning path consists in providing technical and practical notions for the performance that allow students to act on civil and industrial systems by installing new ones and carryng out both extra- or-ordinary maintenance interventions. The course is divided in 3 years for a minimum of 2970 hours and a maximum of 3168 hours and it is addressed to 55 students.

The main teaching areas are:
-PLANNING AND ORGANIZATION OF THE WORKFLOW OF A ELECTRICAL SYSTEM PLANT
-ELECTRICAL SYSTEM INSTALLATION
-ELECTRICAL SYSTEM SUPERVISION
-ELECTRICAL SYSTEM MAINTENANCE

First Year: total hours 990

Subjects:

- ITALIAN LANGUAGE - 132 hours
- ENGLISH- 83 hours
- INFORMATION AND COMMUNICATION - 66 hours
- MATHEMATICS – 132 hours
- SCIENCES - 54 hours
- HISTORY – 56 hours
- LAW - 54 hours
- GRAPHIC REPRESENTATION TECHNOLOGIES AND TECHNIQUES – 99 hours
- INTEGRATED PHYSICAL SCIENCES – 66 hours
- INTEGRATED CHEMISTRY SCIENCES - 66 hours
- LAB. TECHNOLOGICAL -165 hours
- ED. PHYSICS - 56 hours
- RELIGION – 27 hours

Second Year: total hours 1042

Subjects:

- ITALIAN LANGUAGE - 106 hours
- ENGLISH - 78 hours
- INFORMATION AND COMMUNICATION - 58 hours
- MATHEMATICS - 110 hours
- SCIENCES - 52 hours
- HISTORY - 52 hours
- LAW - 52 hours
- GRAPHIC REPRESENTATION TECHNOLOGIES AND TECHNIQUES - 96 hours
- INTEGRATED PHYSICAL SCIENCES - 49 hours
- INTEGRATED CHEMISTRY SCIENCES - 49 hours
- LAB. TECHNOLOGICAL - 160 hours
- STAGE - 160 hours
- ED. PHYSICS - 52 hours
- RELIGION - 26 hours

Third Year: total hours 999

Subjects:

- ITALIAN LANGUAGE - 94 hours
- ENGLISH - 71 hours
- MATHEMATICS - 82 hours
- HISTORY - 48 hours
- LAB. TECHNOLOGICAL - 155 hours
- MECHANICAL TECHNOLOGIES AND APPLICATIONS - 15 hours
- ELECTRONICS TECHNOLOGIES AND APPLICATIONS - 155 hours
- TECHNICAL INSTALLATION AND MAINTENANCE TECHNOLOGIES - 93 hours
- STAGE - 240 hours
- ED. PHYSICS - 48 hours
- RELIGION - 22 hours

ROMANIA

According to the National Qualifications Framework, in the field of Construction (Construction, installation and public works), at qualification level 3, there are defined 10 occupations for which professional training is made:
1. Electrician for construction
2. Electrician for mining exploitations
3. Electrician for ships
4. Electrician for low-voltage operations
5. Electrician for electrical and energetic equipment
6. Electrician for protection by relays, automation and measurements in electrical installations
7. Electrician for generating plants, stations and networks
8. Electrician for drilling-extraction equipment
9. Manufacturer of electro- technical products
10. Electrician for maintenance and repairs of household appliances

The training for these occupations lasts 3 years, with a total of 2.328 hours.

The curriculum was designed according the Professional Training Standards related to the 10 occupations. In the first year of professional training (Grade IX), the curriculum is the same, in terms of subjects and number of hours, for all 10 occupations. The training is done for general technical knowledge that is common to the 10 occupations. The total number of training hours is 456h (Specialized culture and practical training- 306h and Practical Training Internships- Local Development Curriculum- 150h).

In the second year of professional training (Grade X),), the curriculum is the same, in terms of subjects and number of hours, for all 10 occupations. The training is done for general technical knowledge that is common to the 10 occupations. The total number of training hours is 942h (Specialized culture and practical training- 672h and Practical Training Internships- Local Development Curriculum - 270h).

In the third year of professional training (Grade XI), the curriculum begins to differentiate, in terms of subjects and number of hours, for each occupation. The training is done for the specific technical knowledge for each occupation. The total number of training hours is 930h (Specialized culture and practical training- 630h and Practical Training Internships- Local Development Curriculum- 300h).

The content of "Specialized culture and practical training" is establishes at national level by the National Curriculum, while " Local Development Curriculum" is designed by the school and the practice organization, with the approval of the County School Inspectorate.

Training Content Related to Green Skills

In this part we scanned the selected lessons on electric sector in partner countries and found the content related to environment on these selected content and we also make some recommendations about that training content.

TURKEY

There is a field as electric electronic technologies in MEGEP. We scanned all the content in this system. Table is as following:

	Any content related to green skills	**Recommendation that need to be included**
AC Motors, Control, Coil Methods	Some information about the importance of energy saving and, loss of electric on electric lines in Turkey. Dialectic Loss is the energy loss because of insulation material.	There is no information about what will be done with waste materials for instance old engines or cables or insulation materials. Batteries are very harmful for environment for example. Units must mention about what will be done with waste materials. Techniques that increase the efficiency of engines are important for energy saving. The methods and basic warnings to increase energy saving are necessary. Unit gives information about different types of engines. Engines shall be compared according to energy efficiency too.
Network Components and Network Systems	WAP is designed by the purpose of minimizing energy consumption.	Network systems also consume electric. Warnings about minimizing energy consumption will be helpful. Info about what will be done with waste components and equipments is necessary.
Smart Home Devices	One of the main reasons of home automation is energy saving. The factors that increases the energy consumption in a normal home are: -Inability to benefit from daylight -Fast heating and cooling for short periods - Unnecessary use of lights - Heating of unused areas of the house - Devices left open Use of lights at 90% the life of device can be increased 100% and use of energy can be saved as 10 %.	The units don't include information about the aftermath of the broken devices. There shall be information about how these device sor components shall be demolished.

	There is information for different devices about the contribution of smart devices from the aspect of energy saving.	
Smart Home Systems	Smart home systems contribute to energy saving. One of the objectives of smart home systems is energy saving. Unit gives details about the contribution of smart home systems from the aspect of energy saving for instance air conditioner can increase the temperature one hour before you came to home and you don't need to heat the house when you are not at home. Programmable logic controllers (PLC) are used for energy saving.	
Elevator systems	Oil leakage at underground elevator systems can pollute the underground water sources. Take to the floor system use less energy when it is used slower.	Some information about the energy saving of elevator systems can be useful. Especially in big buildings there are more than one elevator and the use of these elevators shall be coordinated well to reduce energy consumption. Information about the potential pollution risks because of oil leakages shall be mentioned more because it is not risk for only the underground systems. Lift systems use batteries and batteries are very harmful for nature after their use. They shall be demolished by special ways. There shall be information about this.
Printing machines		Warnings for energy saving needed. Inks are chemicals used for printing. They are harmful for nature. There shall be warnings about how to clean the machine and use the inks efficiently.
Multimedia equipments	There are very few information about the multimedia systems' key part on energy saving. For instance powerful ampules at Project machines increase the energy consumption. Transformation of energy to the heat causes at ampules of	Unit is about electronic equipments. Some of them have batteries. and batteries are very harmful for nature after their use. They shall be demolished by special ways. There shall be information about this.

	projection machines.	Comparison between different models from the aspect of energy saving will be helpful.
Patch Panel Systems	There is some information about how electronic counters contribute to energy saving at the system. These counters are one of the main parts of electric consumption time shifts. Overload at the system causes energy loss at lines. By encouraging the people not to use electric at pick hours is an advantage and we do this by pricing electric used at different time zones. Unit mentions about electronic counters are energy saving.	
DC Motors Coil Methods	There is a warning that chemical products used at clean of motors can be harmful for nature so please use them carefully.	There is no information about what will be done with waste materials for instance old engines, cleaning or insulation materials. There shall be some information about potential harms to the nature and what is the role of a technician to avoid this harm.
Electric Machines and Control Systems	Some information about what increases energy consumption during repair of AC and DC machines. These are very practical and useful information for technicians. Some warnings at different systems on energy saving.	There is no information about what will be done with waste materials including oil and other chemicals. Units must mention about what will be done with waste materials. Techniques that increase the efficiency of engines are important for energy saving. Technicians shall know which motor is better for energy saving in what condition.
Electric Engines		Units mention about use of chemicals. There shall be warnings about not to use them unnecessarily.
Industrial Electric Systems	There is some information about how electronic counters contribute to energy saving at the system. These counters are one of the main parts of electric consumption time shifts. Overload at the system causes energy loss at lines. By encouraging the people not to use electric at pick hours is an advantage and we do this by pricing electric used at different time zones.	Unit has a sub unit as powerful installation. This unit mentions about the big factories' electric need. These plants consume too much energy so energy saving is so important. The design of lightening or machines or electric infrastructure may cause energy loss. This sub unit needs parts directly related to energy saving. There are especially energy saving systems

	Unit mentions about the methods and materials that are cost saving. These systems used in powerful installation. (Busbar systems)	that are expensive at the beginning. But these are perfect for big plants.
Energy Transfer and Protection Systems	HCDC type electric transfer is energy saving according to AC type electric transfer.	Energy loss is too high at electric transfer lines so an introduction about this cost is so important for students to understand the problem better. Information about general situation of lines in the country will be helpful. There must also be information about how to deal with it.
Energy Production and Distribution Centres	Energy Production Technology shall not damage the nature. Natural gas is preferred in Turkey because it is nature friendly. Wind energy, wave energy, geothermal energy, solar energy are listed as nature friendly technology. Thermic santrals use electro filter to minimize the harmful gas oscillation. There are some information about the waste of different types of plants.	There are several types of energy production plants. There shall be a comparison between them according to their effect to the nature. Units mention about this type has some nature risks but they are not detailed. For example there shall be more information about the potential effects of nuclear plants. There are some information about the waste of different types of plants. But there shall be information what can be done to decrease these wastes and their effct to nature. Wind energy, wave energy, geothermal energy, solar energy are listed as nature friendly technology. Nature friendly technology can also affect the nature. Units shall mention on these effects
Heaters and cooking Household Appliances		There is very few information about energy saving but especially heaters consume high level of energy. There is not sufficient information about what kind of appliances are energy saving. Technicians are opinion leaders on buying these appliances. They shall know which of them are energy saving.
Vocational Development	There is a sub unit as Nature Protection. This sub unit gives general information on environment and potential risks. Nature pollution, Noise, energy resources and especially renewable energy resources, Wastefulness, are main topics.	

Refrigerators and Air Conditioners	Unit mentions about the potential effects of air conditioners on nature. Air conditioners consume high level of energy. Unit warns students about the standards and rules will tighten in coming years on air conditioners energy saving. Energy saving is mentioned at selection of air conditioner.	Place of air conditioner affects the energy saving. Some information is needed about this. The gases of refrigerators can be harmful for air. There shall be information about that.
Construction Electric and Powerful Plants	Alpek cables nature friendly and minimize felling trees. Using more than one stairs lightening in big apartments contribute energy saving. Outdoor lightning has a risk of energy loss by lighting the sky. Which types has this risk.	Using energy saving equipments is very important. Electric technicians can influence the households so they shall know the energy saving methods and inform the people. Units shall have more information about equipments and materials used for energy saving.
Low voltage current Plants and Electric Installation Projects	Lightening sub-Unit says that lightening calculation for energy saving. Energy saving doesn't mean turning off some street lights. This is risky.	

SPAIN

	Any content related to green siklls	**Recommendation that need to be included**
Industrial automation	Locate faults and malfunctions in the installation Identification of possible sources of contamination Classification of wastes In this module there is a section called "Prevention of occupational risks and environmental protection" with a topic related to compliance with **environmental protection regulations in industrial automation**	How to improve industrial automation according environment Environmental considerations in the location of industrial facilities. Action and safety protocol in automatic processes of special sensitivity. Ej nuclear energy, chemical products etc.
Electronics	Functions and characteristics of electronic equipment and elements used in electrical installations related with the environment	ECO certification and labelling on electronic devices. Life cycle assessment on electronic devices. Recycling of the electronic devices Ecodesign in electronics

		(PCB) "Print Circuit Board" Enviromental considerations in the manufature of semiconductor components with chemical products such as sulfuric acid.
Electrical engineering	-	Environmental legislation on high and low voltage networks.
Indoor electrical installations	"Prevention of occupational risks and environmental protection" is a section in this module , inside there is a topic related to compliance with **environmental protection regulations in indoor electrical installations.**	How to improve energy efficiency in indoor systems. Take advantage of availale natural resources to minize the environmental impact.
Training and career counseling	-	Recommendation of doing a course of electrical efficiency and Ecodesigner in electricity systems
Electrical power distribution facilities	Within the module is a section called "Prevention of occupational risks and environmental protection" that incorporates a topic related to compliance with **environmental protection regulations in electrical power facilities**	Solutions and energy saving systems. The most efficient energy managment systems.
Common telecommunication infrastructures in buildings	In this module there is a section called "Safety, prevention of occupational risks and environmental protection" and inside there is a topic related to **recycling and environmental protection.**	Ecodesign in Smart grids and smart cities. Effects of electromagnetic energy on the environment and considerations on the location of antennas.
Domotic installations	Within the module is a section called "Prevention of occupational risks and environmental protection" is present in this module and it is including a topic related to compliance with **environmental protection regulations in Domotics installations**	Reduction of energy consumption. Adaption to lighting conditions of the exterior. Power the sensor networks with energy harvesting systems.
Solar energy photovoltaic installations	Identification of the elements which are configurating solar energy photovoltaic facilities. Use of Specific measuring instruments - solarimeter Also, in this modulethere is a section called "Prevention of occupational risks and environmental protection" that	International and European environmental standard and directives on solar energy. Enviromental considerations obout authorized locations to distribute solar panel installations.

	incorporates a topic related to compliance with **environmental protection regulations in solar energy installations**	
Electric machines	Within the module is a section called "Prevention of occupational risks and environmental protection" that incorporates a topic related to compliance with **environmental protection regulations in electric machines**	International and European environmental standard and directives on electric machines. Level of noise allowed according to environmental legislation.
Business and Entrepreneurship	-	Bussiness related with environment in electricity and electronics
Formation in work centers	-	Practical activities about electicity and electronics

There is training content that is directly related to gren skills in curriculum named as Formative Cycle of Use and Conservation of the Natural Environment. This professional works in large, medium and small companies, both public and private, dedicated to the work of afforestation, restoration and hydrological-forest management and forest harvesting as well as control and monitoring of the natural environment.

UK

Defining the Target Group

Target Level
The target group for this project was set as 'Vocational Education Trainees at ISCED Level 3 – age 15-17. Fitting the UK system to this target is not straightforward.

Firstly, the UK definition of vocational education is not concrete, as discussed above. Secondly, 15-17 is not applicable age range for the UK. National examinations (including 'vocational' qualifications) are taken at ages 14-16 during compulsory education. Vocational education after 16 is often referred to as 'post-16', or 16-18.

Finally, ISCED is difficult to apply to the UK for a number of reasons. ISCED's 2011 release treated the UK as a whole, and categorises by institution or provision type rather than qualification difficulty. This means ISCED 3 refers to RQF/CQFW Levels 2 and 3 (SCQF Levels 5 and 6) (OECD, 2018). Due to the pan-European purpose of this report, we have followed the example of the European Qualification Framework (EQF). The framework aligns to ISCED (EQF 3 is ISCED 3). In the UK, EQF 3 equates to RQF/CQFW Level 2 and SCQF Level 5. These levels are mainly taken by post-16 learners, though are available to learners of all ages.

Target Occupation
This project focuses on electrical work in the construction industry. As such, we examine electrical installation qualifications currently available under the Sector Subject Area (SSA) 5: 'Construction, planning and the built environment' and sub-SSA 5.2: 'Building and construction' and in Scotland, qualifications under Area of Competence 003: 'Constructing'. Qualifications for specific green technologies such as solar panels, for example, come under 'Engineering and Manufacturing Technologies'.

Qualifications for electricians at this level come in two types: 1) electrical installation qualifications and 2) general construction qualifications with optional electrical installation components. For example, *Pearson BTEC Level 2 Certificate in Construction and Built Environment* contains an Optional Specialist Module for Exploring Electrical Principles and Techniques. This report examines those qualifications specific only to electrical installation.

Data Sources

Ofqual provides an open access register of all available qualifications for England and Northern Ireland(https://register.ofqual.gov.uk/), as does Qualifications Wales for Wales(https://www.qiw.wales/). All data taken from these databases were correct as of 5th December 2018. Scotland does not provide a downloadable database for all qualifications, therefore data for currently available construction qualifications were taken manually from the SCQF's database(https://scqf.org.uk/the-framework/search-database/) and the most recent qualification registration and award quarterly (SQA Accreditation, 2018).

Qualifications for Electricians

Electrical installation qualifications are some of the most popularly awarded in the UK. For July-September 2018, *City & Guilds Level 3 Award in the Requirements for Electrical Installations* was the 25th most issued qualification in England for the quarter July to September 2018, at 9350 certificates (Ofqual, 2018).

The following table demonstrates the number of qualifications awarded specifically for electrical installation (i.e. excluding general construction qualifications with electrical options.) for construction in the period July to September 2018. The table also demonstrates the number of qualifications available to all levels in each country, as well as at the project level of EQF 3.

Country	Total awards Jul-Sep 2018[14]	Total awards Jul-Sep 2018 at EQF 3	Qualifications Available	Qualifications Available EQF 3
England	23,600	4,860	49	6
Northern Ireland	Data unavailable for Northern Ireland due to CCEA website relocation issues at time of writing.	-	31	2
Wales	1155	135	25	2
Scotland	146	0	5	0

Table Electrical Installation in Construction Qualifications

Scotland has a lower number of qualifications due to its separate system and efforts to streamline its vocational education provision. The first qualification for electrical installation (outside of more general construction qualifications) is the SVQ in Electrical Installation at SCQF 7 (EQF 5) and therefore outside the target group remit for this project.

Three of the qualifications available at EQF in England concern highway maintenance – which is counted as part of the construction sector. These qualifications are not included in the following section, which focuses on building construction.

Green Skills Content Analysis

The following tables demonstrates the availability and duration of the four qualifications available at EQF 3 for electrical installation.

AO	Qualification	Country	Duration
City and Guilds	Level 2 IVQ Diploma in Electrical Installation(https://cdn.cityandguilds.com/ProductDocuments/Construction/Construction/6161/6161_Level_2/Centre_documents/6161_L2_Qualification_handbook_v3.pdf)	England, NI	-
City and Guilds	Level 2 Diploma in Electrical Installations (Buildings and Structures)(https://www.cityandguilds.com/-/media/productdocuments/building_services_industry/electrical_installation/2365/2365_level_2/centre_documents/2365-02_l2_electrical_installation_qualification_handbook_v1-7-pdf.ashx)	England, NI, Wales	490 hours
City and Guilds	City & Guilds Level 2 Technical Certificate in Electrical Installation(https://www.cityandguilds.com/-/media/productdocuments/building_services_industry/electrical_installation/8202/level_2/centre_documents/8202-20_l2_technical_certificate_in_electrical_installation_qualification_handbook_v1-3-pdf.ashx)	England	600 hours
EAL	EAL Level 2 Diploma In Electrical Installation(https://eal.org.uk/centre-support/eal-sectors/electrotechnical/16-level-2-electrical-installation-textbook- sample/file Sample Environmental chapter: https://eal.org.uk/centre-support/eal-sectors/electrotechnical/16-level-2- electrical-installation-textbook-sample/file)	Wales	486 hours

Table EQF 3 Qualifications for Electrical Installations

The following table identifies the green skills content within each unit of each qualification, as well as a recommendation for additional green skills content where applicable.

Level 2 IVQ Diploma in Electrical Installation		
UNIT	**Green Skills Content**	**Green Skills Content Recommendations**
Electrical Installation: Safety at Work	"Use and store toxic materials in a safe manner"	Knowledge of recycled materials and low-energy products such as low energy- excluding LED bulbs could be included as a practical competence, as per governmental guidance on waste knowledge
Electrical Installation: Materials	Must prepare a report on the suitability of materials, and a report on the environmental effects of electrical generation, transmission and distribution.	-
Electrical Installation: Calculations, setting out and drawing	No	Environmental case studies could be used in examples for drawing/calculations/setting out.
Electrical Installation: Practical skills	No	This unit introduces the learner to the installation of electrical systems and the inspection of single phase domestic installations. The learner could also be introduced to energy efficient design as per the International Electrotechnical Commission's international standard for low voltage electrical installation (IEC 60364-8-1[21]) and green inspection standards such as BREEAM.
Electrical Installation: Communications and IT	The learner must be able to use of national and international standards (including environmental).	-

Electrical Installation: Alteration, repair and planned maintenance	The learner must be able to replace existing accessories with upgraded units. This includes the identification of energy inefficient components and the scope to replace those with more efficient, upgraded units.	-
Level 2 Diploma in Electrical Installations (Buildings and Structures)		
UNIT	**Green Skills Content**	**Green Skills Content Recommendations**
Unit 201 Health and safety in building services engineering	"Assessment Criteria: identify roles and responsibilities with regard to current relevant environmental legislation." The learner is assessed on their awareness of environmental legislation.	
Unit 202 Principles of Electrical Science	No	This unit deals with the mathematical and scientific principles of electricity. Environmental case studies could be used in example material.
Unit 203 Electrical installations technology	No	This unit is a practical introduction to safe tool use and testing wiring systems. As a core skill, green content may better suited elsewhere. The learner could also be introduced to energy efficient design as per the International Electrotechnical Commission's international standard for low voltage electrical installation (IEC 60364-8-1) and green inspection standards such as BREEAM.
Unit 204 Installation of wiring systems and enclosures	"Assessment Criteria: identify methods of generating electricity including renewables." The learner is assessed on their knowledge of renewable electricity generation.	-

Unit 210 Understand how to communicate with others within building services Engineering	This unit focuses on inter-sector communication. Buildings Inspectors and environmental legislation is included.	Key terms of environmental issues could be examined in order to improve communication with different groups.
City & Guilds Level 2 Technical Certificate in Electrical Installation		
UNIT	**Green Skills Content**	**Green Skills Content Recommendations**
Unit 201 Health and Safety and Industry Practices	The learner is introduced to environmental legislation such as the Hazardous Waste Regulations and environmental protection.	-
Unit 202 Electrical Science	No	This unit deals with the mathematical and scientific principles of electricity. Environmental case studies could be used in example material.
Unit 203 Electrical Installation	The learner identifies factors that can affect electrical systems: environment, building, as well as the selection of systems for longevity and external influences. This allows the learner to consider energy efficiency in system design.	-
Unit 204 Electrical Technology	The learner is introduced to methods of generating electricity for distribution including renewables.	-
EAL Level 2 Diploma In Electrical Installation		
UNIT	**Green Skills Content**	**Green Skills Content Recommendations**
Health and Safety in Electrical Installation	The learner must demonstrate knowledge of legislation including environmental protections and the proper disposal/recycling of waste materials.	-
Electrical Installation Theory and Technology	The learner is introduced to methods of generating electricity for distribution including renewables.	-

Electrical Installation Methods, Procedures and Requirements	This unit focuses on inter-sector communication. Buildings Inspectors and environmental legislation is included.	Key terms of environmental issues could be examined in order to improve communication with different groups.
Electrical Installation Craft Skills	No	This unit is a practical introduction to safe tool use and testing wiring systems. As a core skill, green content may better suited elsewhere. The learner could also be introduced to energy efficient design as per the International Electrotechnical Commission's international standard for low voltage electrical installation (IEC 60364-8-1) and green inspection standards such as BREEAM.
Electrical Science and Principle	No	This unit deals with the mathematical and scientific principles of electricity. Environmental case studies could be used in example material.

Table Analysis of Green Skills Content in EQF 4 Electrical Installation Qualifications

ITALY

	Any content related to green skills	Recommendation that need to be included
Electrical and electronic technologies and their Applications: (ELECTRIC AND ELECTRICAL MACHINERY, PLANTS, ELECTRICAL SAFETY, ENVIRONMENTAL PROTECTION DEVICES AND METHODS, MATERIAL ANALYSIS, LCA, COOLING AND HEATING SYSTEMS, PASSIVE AND ACTIVE IMPAINTS, CEI STANDARDS, EIA, ETC ...)	- This section contains the general principles of electrical and electronics engineering. In particular, there are notions regarding how to know the electrical and electronic machines. For example: operation, use, construction aspects, electronic drives and the energy consumption when they worked. Furthermore, there are environmental impact notions concerning both the equipment and the electrical and electronic distribution and automation systems. - Inside this section there are described, concepts concerning to the electrical and the electronic safety of devices and the protection methods related both to man and to the environment. - An important part of the lesson deals with the analysis and the description of the various materials and components, certified as materials with low environmental impact. Some analyses are carried out both on their use and on their performance. These actions help to understand the environmental consequences caused both directly and indirectly and therefore give to the decision makers the information necessary to define environmental effects and identify opportunities for improvement regarding the environmental aspects. - In addition, comparative studies are carried out on how design heating and cooling systems in terms that they can minimize both the use of electricity and the exploitation of natural	It is necessary to go deep and explain and analyse better how choose the materials and components in relation to the respect of the environment and it is helpful to know better which are the technologies that can help to protect the environment in the electric field.

	resources. - In the lesson also, there are information on: overload and short-circuit protection, measuring tools and measurement techniques with voltmeter, ammeter, tester, wattmeter, oscilloscope, in terms of minimization environmental impact for both the individual components and the overall electrical system. - This section also describes and analyzes the energy production and use. It is based on three key components: one related to the production (and therefore linked to the renewable energy), another linked to its use, efficiency and energy saving, and finally the last linked to the environmental impact in terms of pollution. - In addition, there are also concepts on how to distinguish passive and active plants, in order to have a general overview of both the rational energy use and energy efficiency. - In this section there is also a description of a product / material life cycle: -"Life cycle assessment (LCA)"- , and its phases from the pre-production to the final disposal. In particular, this section analyzes the various components used in the electricity sector, from their production to their disposal or recycling. - A large part of the module is dedicated to study, description and analysis of European and national regulations that have to be applied in the electricity sector. Concepts, on how to certify the plants setting up and machines, in terms of operation, quality, safety and respect for the	

	environment. In particular, it is examinated the CEI regulation. This legislation refers to the section on environmental safety intended as protection of people and things that interact with the environment in full compliance with the specific standard CEI 64-8. In this standard are provided specific notions about the energy efficiency electrical systems design, environmental protection concepts on the powers to be evaluated during the design phase, sizing of the power lines, calculation of the conductors capacity, coordination between the device protection and cable, conductor temperature evaluation, conductor thermal behavior, distribution systems, etc ... - In addition, it is described the methods of how to conduct the energy certification of a plant or a system. In the Environmental Impact Assessment (VIA) document is studied the environmental aspects of activities, processes, materials and plants with the purpose of defining the prevention and protection measures.	
Technologies and techniques of installation and maintenance, (STANDARDS, ENVIRONMENTAL CERTIFICATIONS, MEASUREMENTS, CONTROLS, ROAD, APE, ENERGY CONVERSION, ETC ...):	- In this section there are concepts on how to recognize and designate the main electronic and electrical components; on how to interpret the data and the technical and environmental characteristics of system components. For example: how much energy they consume? What are the maximum loads and minimums that an installation can support?, Etc ... - Concepts on how to certify the plants setting up and machines related to: operation, quality, safety and respect for the environment. Furthermore, it is described how to use the tools, suitable methods and technologies for maintaining operating conditions and	It is necessary to know how to identify the problems related to the electric field and be able to use strategies oriented to the environmental protection result in compliance with professional ethics and in reference to the legislation in force. For example, putting into practice the knowledge acquired through the control and monitoring of a real electrical system.

	which comply with the human health and environmental protection regulations. - In this section there are also practical and theoretical exercises on how tests are performed. Thanks to it, it is possible to identify the most suitable tools for measurements and controls to be carried out in compliance with environmental regulations. - In this section there are some guidelines to carry out the "VIA": the environmental impact assessment of a plant or building and how to achieve the "APE" the energy certification in order to examine the prevention criteria and environmental protection related to the management of operations on equipment and systems. - It also explains how to calculate the characteristics of energy conversion plants. For example: yields, energy requirements, emissions calculation or estimation: CO2, HC, NOx, etc... - There is also machines and components description during their installation phase, and the recognition of the environmental labels and the calculation of the energy consumption that machineries used.	
Technological laboratories, (PLANT DESIGN, ENERGY SAVING, HEAT, TEMPERATURE, CLIMATE, CLIMATE CHANGE, ECOLOGY, SPECIFIC HEAT, TRANSMITTANCE, ETC ...):	- In this section there are notions of plant efficiency. Particular attention is given to the integrated planning of a system. This has as objective to be environmental sustainability, energy efficiency and energy saving. - In particular, it analyzed the concept of heat and temperature. Specifically, it is analyzed the active and passive environmental control systems, paying particular attention to the heat calculation, thermal power, specific material heat, capacity and thermal	It is necessary to carry out tests and measurements in the laboratory, in order to identify and use tools and technologies suitable for the type of maintenance work to be performed, respecting the workplace and the environment.

	resistance, transmittance and heat flow. - In addition, there are notions about climate and the consequences of the climate changes. To students is offered a general overview of the current status and modification of the planet in reference to the exploitation of the Earth's resources. - Considerable attention is also paid to the "ecology", or how to protect the environment through the sustainable use of natural resources and through proper waste management. - There are also provided some tools to conduct an analysis to interpret the natural phenomena or the artificial systems related to energy aspect, distinguishing the various transformations of energy in relation to the laws that govern them.	
Technologies and Techniques of Graphic Representation, (SOFTWARE, IDENTIFICATION OF ENVIRONMENTAL LABELS, DESIGN, DRAWINGS, ETC ...):	- This module includes notions on how to analyse and interpret data by developing deductions and reasoning thank to graphic representations, calculation tools and specific IT applications. Specifically, there are concepts on how to read and reproduce mechanical drawings using CAD software. In In this section, particular importance is placed on how to organize all the operational phases, distinguishing and cataloging the possible uses of energy, the various energy sources, the machines, the components, etc …	Knowing how to identify the power supply methods and related environmental protections. Understanding the behavior of a capacitor as an electrical component, in order to predict its environmental sustainability.
Mechanical Technologies and Applications, (RENEWABLE ENERGY, NON-RENEWABLE ENERGY, PHOTOVOLTAIC,	- Here, there are notions about the different forms of energy. Both renewable energies: solar, wind, geothermal, marine and hydropower energy and energy produced from biomass, and non-renewable energy: as fossil fuels and sources of nuclear energy.	Practical execution of the knowledge gained on renewable energy while respecting the environment, through experiments or workshops

EOLIC, GEOTHERMIC SYSTEMS, ENERGY TRANSFORMATION, STANDARDS AND APPLICATIONS, ETCC ...):	- In addition, In this lesson there are concept on how design the plants that use different kinds of renewable energies. For example plants that use thermal, photovoltaic, geothermal and wind power and the mix of these kinds of energies. - Notions on how to analyse qualitatively and quantitatively phenomena related to energy transformations starting from practical experience. - Notions on how to apply the environmental safety legislation to the electrical sector, on how to build a generic electrical system by developing the techniques related to plant and environmental safety. There are also Notion on how to read and interpret safety regulations and how to realize plants using compliant devices to current legislation on safety and the environment.	

ROMANIA

To compare the curriculum the occupation **Electrician for construction** was chosen:

The module	The learning content refers to Green skills	Recommendations
General technologies in electrotechnics	Is studying the graphic representations, measuring and control means, general locksmithing; environmental protection and waste management rules related to general locksmith works; recovery and reuse of materials; preparatory works of technological processes (cleaning, pick lung, removing the insulation); environmental protection and waste management rules related to preparatory works; ways to warn about hazards at work.	-Selection of the waste from modeling, mechanical and physical treatment of metal surfaces and plastics -Selection of packaging waste in electric field -Information about circular economy: waste and resource use are minimized, the value of products and materials is kept as long as possible, and resources are re-used and value added. -Information about reusable materials in the electric field
Components of electrical equipment	Is studying the classification and general characteristics of electrotechnical materials; materials used in the manufacture of electrical equipment components; electrical equipment components; environmental and Waste Management norms; waste management for environmental protection; recovery and reuse of materials	-Selection of the waste from modeling, mechanical and physical treatment of metal surfaces and plastics -Selection of packaging waste in electric field -Information about circular economy: waste and resource use are minimized, the value of products and materials is kept as long as possible, and resources are re-used and value added. -Information about reusable materials in the electric field
Electric measures for continuous current and in alternating current	-no references to Green skills	-For medium and low voltage power lines the impact with the environment relates, in particular to: land occupation, forest clearing, visual pollution and impact with other building elements and installations. -The impact of magnetic and electric fields on human health: stimulation

		of nerve and muscle cells by induced currents is the principal acute effect considered
Electric devices	Is studying the low voltage electrical devices; installation and execution of electrical devices connections; low voltage electrical appliance requests; maintenance works for low-voltage devices; environmental protection and waste management rules; recovery and reuse of materials in dismounting / maintenance operations of electrical devices.	-information about smart light bulb, smart plug
Electric machines	Is studying the general notions about electric cars; installation and execution of electrical machine connections; maintenance work for electric machines; rules of environmental protection and waste management: ways of recovering and reusing materials in work of mounting / maintenance electrical machines.	Information about: -the operating principle of the electrical generators using renewable sources -alternative energies more accessible and more efficient: how resources are used alternatives (solar, wind, nuclear, hydroelectric, geothermal) for energy generation.
Electrical installations specific to buildings	Is studying the electrical installations specific to buildings (for civil, industrial, office, office space); materials specific to electrical installations of weak, light current and power; electrical appliances required for the construction of electrical installations specific to the buildings; electric machines used in electrical installations for constructions; technology for the realization of electrical installations of weak currents, of light and power specific to constructions; verification of electrical installations of weak currents, light and power; requests specific electrical building installations due to the environment: • causes and effects of requests electrical installations executed; • methods / measures to limit requests; maintenance, repair and verification of electrical installations of weak currents, of light and power specific to the constructions; environmental and waste management rules: - environmental protection norms: environmental protection law, European environmental norms, technical norms for organizing and carrying out environmental protection activities specific to construction works; - waste management rules: legislation on waste avoidance, recycling and re-use: the	Information about: - calculating the energy requirement in a household and design of a solar energy system based on this need. - LED illumination Energy efficiency, Lighting quality and visual comfort, Concept and aesthetics -"Intelligent house" is a concept of a central station that receives information from a series of sensors, and through scenarios made at the initial programming, it sends commands to relays on/of or directly to electric consumers. -international wireless communication language called Z-wave: automatic lighting controls, automatic shutter controls, attic windows or automatic blinds, all from information provided by sensors or

	waste categories, recyclable industrial waste; - rules on air pollution near construction sites.	from manual orders via phone or tablet, which can trigger simple on / off scenarios or programmed in the same way of such conditions.
Electrical installations for solar panels	Is studying the converting solar energy into electricity; conversion of solar energy into thermal energy; solar panels for electrical installations; electrical components and apparatus specific to solar panels; the technology of making electrical installations for solar panels; verification of installations for solar panels; quality standards; maintenance, repair and verification of electrical installations for solar panels; environmental and waste management rules: - environmental protection norms: environmental protection law, European environmental norms, technical norms for organizing and carrying out environmental protection activities specific to construction works; - waste management rules: legislation on waste avoidance, recycling and re-use: the waste categories, recyclable industrial waste;	-information on the efficiency of solar panels

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