



# GREEN SKILLS

## At Vocational Education

Project Number: 2017-1-TR01-KA202-046803

“Recommendations for policy makers about the inadequacies of vocational education for electricians’ from the perspective of green skills concept”



Erasmus+



# RECOMMENDATIONS FOR POLICY MAKERS ABOUT THE INADEQUACIES OF VOCATIONAL EDUCATION FOR ELECTRICIANS' FROM THE PERSPECTIVE OF GREEN SKILLS CONCEPT

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



Co-funded by the  
Erasmus+ Programme  
of the European Union

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## 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.

## 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

## About Report

The main objective of the project is raising awareness of the policy makers and other stakeholders in vocational education system about the green skills for 2 professions (electricians and construction workers). This report (recommendations paper) has been developed to make recommendations to policy makers, VET professionals, VET trainers, and other stakeholders on how to promote green skills at electric vocational training. All partner countries have totally different VET systems so the recommendations are different from each partner country. The report has been prepared country-based. We focused on training content, physical infrastructure of VET institutions, role of practical training and internships, trainer skills, changes needed at VET systems.

We used O1, O2 and O4 for developing this report. We received thoughts of VET experts, trainers and trainees by workshops for this report.

## Recommendations for policy makers about the inadequacies of Vocational education for electricians' from the perspective of green skills concept.

### TURKEY:

#### Introduction:

Turkey is an EU member candidate country and is trying to make its all systems closer. Education is one of the most problematic fields on this subject because EU has not a Standard education system. Each country has its own experience and system. Although this fact, education and especially vocational education need some principles for all EU countries. EU has an agency CEDEFOP that supports



development of European vocational education and training (VET) policies and contributes to their implementation. The agency is helping the European Commission, EU Member States and the social partners to develop the right European VET policies and Erasmus+ VET program is working for sharing knowledge and experience between countries. Turkey is a stakeholder as a candidate country for Erasmus+ program.

Technology changing very rapidly and this change affects all sectors. We explore and develop the better ways of doing sth. And this change cause new problems. Environmental problems are one of these new problems and its solution is global and versatile. Developing environment-friendly Technologies is one of the most important aspects of the solution but we can implement these new measures with only qualified workers. Workers shall know which methods and materials are better for environment, what are the possible behaviours for better environment at their sector as a worker. This needs a comprehensive strategy for each country because VET systems are big and complicated. There shall be several measures taken by VET policy makers in each country and these measures shall be in compliance.

This report has been developed for the recommendations for VET policy makers in Turkey on how they can contribute to train VET students at electric field from the aspect of green skills.

We had developed that gives information about Turkey's VET system at our previous report - Comparative report about the curriculums for electric workers on green skills. We mentioned about the different types of VET centres at that report. Some of our recommendations are based on that report.

#### **Curriculum:**

Turkey has a centralized education system. Most of vocational education is being supervised by Ministry of National Education so that it is easy to entrain the necessary curriculum to the VET centres. Talim Terbiye Kurulu is the main body that has the right to make necessary changes at VET curriculums. Talim Terbiye Kurulu is linked to Ministry of National Education. Universities are independent and they are not supervised by Ministry of National Education but there is a directive body (Yükseköğretim Kurumu-YÖK) for universities and they can suggest new changes for curriculum.

Increasing green skills of VET students shall start by educating students about importance of environment in general. They shall know why environmental issues are important for our future. There is also a lesson as Vocational Education with Unit Protection of Environment but this unit is not enough because it is too short from the aspect of education time and it contains only general information about environment IT must be linked to electric students.

Public Education centres (Halk Eğitim Merkezleri) has an important place on vocational education in Turkey. These centres provide courses for different purposes. It is better to make some social awareness campaigns for these trainees because they directly attend the courses and they are adults and they don't have enough time a full time environment lesson. There can be some content at some lessons.

Mesleki Eğitim Merkezleri is another type of VET centres in Turkey. These centres are for the people who are also working. The apprentices who are working in a company come to these centres for theoretical education. They come 1-2 times in a week for 4 years. An environment based lesson can be helpful for them.

Curriculum change is not only adding a lesson for environment. Some of the technical lessons are directly linked to green skills. The content of these lessons shall be reviewed and changed. All the contents shall be looked over by experts at environment field before the approval of Talim Terbiye Kurulu. You can see some advices as attached for the training content of vocational high schools. Surely these are only some



examples; the experts shall scan all the content and make necessary content changes. Technology is changing very fast and this review of content shall be renewed at every 5 years. Electricians are important especially for energy saving issues. Energy saving is one of the most important issues at green skills.

### **Raising Awareness on Environment:**

Technology is changing very rapidly and the threats against environment and environment-friendly Technologies also change. This means green skills are not related to some information about the environment at an exact time. It is related to conscious of all stakeholders including the workers. VET students shall be trained on green skills and how to adapt themselves to changing technologies and risks.

We recommend some campaigns for students, teachers, administrators, parents and other staff as background information about environment. There can be some field based campaigns for related stakeholders in electric field. Electric electronic has a wide range of working opportunities. Green skills related to energy saving is very important at this field. VET institutions also consume electricity and promoting energy saving at the schools, workshops will be a good way of raising awareness of VET students trained at electric filed. According to 2015-2019 Strategic Plan of Ministry of Energy and Natural Resources, Ministry is planning to reduce energy consumption 20% at their departments. A similar strategy for Ministry of National Education will be a good example for VET stakeholders.

Job training is an important part of the training. VET institutions work with some sector companies on job training of VET students. Turkish laws obligate all companies to host VET students as interns if it is necessary. This means the companies who host VET trainees for job training can be thought as VET centres and a raising awareness campaign targeting these companies is necessary for green skills.

There are some campaigns organized by Ministry of Energy and Natural Resources on energy saving. We recommend Ministry of National Education and Ministry of Energy to work together for raising awareness campaigns at VET institutions.

Good examples are very important at education and designing some VET schools that are very well equipped on energy saving, have very well trained trainers( may be trained at Europe) can be an important part of raising awareness.

Curriculum development on environmental issues is important but environmental issues have another face too. Mostly they are cost increasing on short term. So there shall be representatives of sector on curriculum development process. Their views are also important. There is a risk of exaggerating environmental measures and to hurt electric sector and industry with these measures.

### **Training of VET Trainers:**

There are 2 main fields under at vocational high schools related to energy in Turkey. First one is electric electronic field; second one is renewable energy field. These 2 fields are mostly having male students. There are also some other VET institutions as people education centres, vocational education centres for apprentices. All the vocational teachers and trainers at these VET institutions shall be trained about green skills at electric- electronic sector. There are thousands of VET teachers at electric field and unfortunately it is difficult to find trainers for training these teachers. So that there shall be a national planning for these trainings.

Ministry of National Education organize distance learning for teachers before the start and after the end of classes every year. Training VET teachers during these trainings can be good idea. Additionally some formal trainings can be organized for VET teachers. Provincial Directorates of Ministry of National Education can take role at these trainings.



Curriculum development of training of teachers shall be organized simultaneously because the content changes on curriculum shall be taught to teachers.

#### **Physical Infrastructure of VET institutions:**

Vocational Education at electric field has lots of workshop activity. The physical infrastructure of the VET institutions shall be reorganized according to the energy saving principles. Students can use new technology products at their workshops. All the workshops shall be changed simultaneously with the curriculum development. The teachers of these workshops also shall be trained about these changes.

#### **Training of existing electric workers:**

Technology is changing rapidly. This also influences the green skills so that training on VET institutions will not be enough. The graduates and the workers on the sector shall be retrained at regular intervals. According to Türkiye'de Mesleki ve Teknik Eğitimin Görünümü Raporu (Outlook of Vocational and Technical Education in Turkey) only 9.3% of the electric students work on the sectors directly related to their education and 44, 83 % of them work at other sectors. This statistics is for the students who are trained between 2008 and 2014. The report is published at 2018 by Ministry of National Education.

This Statistics shows that most of the people on the sector are not trained at VET institutions in Turkey too. These workers shall be trained on green skills at electric sector too. There are some sectors related to electric electronic filed. Electric technicians work at several sectors, big factories, big buildings, construction, electric distribution, electric production, repairing companies etc...

It is difficult to reach the workers at these sectors. Ministry of National Education and related labour organizations, chambers of industries, employer associations shall work together for a wide range of training program. There shall be some raising awareness campaign that can reach to these workers and short term trainings organized by VET institutions.

To reach this wide range of sectors will be difficult but we can recommend starting with the partners of VET institutions. Vocational high schools and Vocational Education centres has close relationships with the companies. They organize job trainings together. Training of existing workers shall start from these companies. Then Ministry of National Education can contact to organized industrial zones. But training only the VET students will not be enough because of 2 reasons:

- 1) In Turkey, graduates of vocational education can work at another field.
- 2) Technology changes rapidly and the green skills also change so the existing workers will need renewal trainings
- 3) Until this date, training at VET institutions was not enough on green skills and this means all the graduates need trainings.

Following national level organizations can be stakeholders for training of trainers:

- a) Enerji ve Tabii Kaynaklar Bakanlığı – Ministry of Energy and Natural Resources
- b) Türkiye Odalar ve Borsalar Birliği- union of chambers and commodity exchanges of turkey
- c) Türkiye Esnaf ve Sanatkarlar Konfederasyonu- the confederation of Turkish tradesmen and craftsmen
- d) Elektrik Üreticileri Derneği- Electric Producers Association
- e) Yenilenebilir Enerji Derneği- Renewable Energy Association
- f) Türk Enerji Sendikası- Turkish Energy Labour Union
- g) Türkiye Enerji İşçileri Sendikası – Turkey Energy Workers Union
- h) Türkiye Enerji Su ve Gaz İşçileri Sendikası- Turkey Energy, Water and Gas Workers Labour Union



i) **Roll Model Schools on Energy Saving:**

There are several VET institutions in Turkey. At 2018, there were 322 mesleki eğitim merkezi (vocational education centres) 2522 Mesleki ve Teknik Anadolu Lisesi (Vocational and Technical High School), 762 Çok programlı Anadolu Lisesi (Multi-program Anatolian High School) 383 Private Vocational High School and 33 Vocational High Schools at Organized Industrial Zones.

There are 4022 VET institutions in Turkey and it is impossible to start a program for all of them at the same time. To increase the support for green skills to select approximately 10 schools as role model VET institutions and start activities in these schools and use these schools as role models with some campaigns will be helpful to draw attention of all stakeholders at vocational education.

## SPAIN

### Introduction

Green Skills steams from the challenge, especially at European level, related to facing the problem of environmental respect and climate change in an innovative and functional way. For that, this project aims at producing recommendations for workers directly involved in the environmental issue, like electricians. Nowadays, according CEDEFOP, skills gaps are already recognized as a major bottleneck in sectors closed linked to “green economy” such as renewable energy, energy and resource efficiency, renovation of buildings, construction, environmental services, manufacturing. Moreover, other sectors need workers and entrepreneurs with those skills. International Labour Organization (ILO) calls on countries to take urgent action to train workers in the skills needed for the transition to a greener economy, and provide them with social protection that facilitates the transition to new jobs. Countries should take urgent action to anticipate the skills needed for the transition to greener economies and provide new training programmes. There is scope for policies in the world of work and training to advance environmental sustainability; and for environmental policies to ensure decent work. A coherent and integrated legal framework is a step in this direction. Advances have been made by including decent work issues in environmental regulations, such as climate action policies that take note of their skills implications. Providing workers with the right set of skills and recognizing workers’ skills will help the transition to sectors with employment growth, and also to better jobs. The relationship between work and the environment will be fundamental in the following years; in fact jobs in many sectors rely on natural resources and GHG emissions directly, while other sectors, by virtue of economic linkages, rely on them indirectly. They are threatened by the increasing scarcity of natural resources and by the limits of the Earth’s capacity to absorb the related waste and emissions. Advancing towards a green economy (transition to a low-carbon and resource efficient) creates and change the employment at the global level. It entails a reallocation of employment across industries and requiring policies to ensure the transition including the acquisition of necessary skills to work in that green future.

### Recommendations

These recommendations are obtained with the analysis of different European and national documents (it can be checked in the Bibliography), previous research of this project and a work group with 6 teachers of Spanish VET system in Electrical and Automatic Installations Technician course or other courses of “Construction and civil works” family. After examining the training course of “Electrical and automatic installation technician”, we have realized that this training is very extensive and general. For that, is very difficult to delve into the different lessons of the courses. That fact could be the reason why the ‘Green Skills’ are not important for the curricula of electricity vocational training.



***Recommendation 1:***

Reorganize the content of training in order that the second course will be more specific. In this way it could be possible to introduce some nuances about “Green Skills” related to the specific subject because the course is not so extensive. The new structure of training could be the following:

*First course:* The first course has to be very general and common for everyone. In this course the students have to learn only the most important and general lessons of the training. This course covers all things that an electrician needs to know independently of the specialization.

*Second course:* In this course the student would have to choose a specific area of training. These could be the following:

- Low voltage networks
- High voltage networks
- Renewable energy
- Automated installations and telecommunications infrastructures.
- Electronical systems
- Electric machines
- Home automated installations

In this way, the VET trainers would have more time to teach about “Green Skills” and could be more specific with the good environmental practices related to the area of training.

***Recommendation 2:***

At the end of the second course, it could be suggested that the students have to make a little project related to specific chosen area at the beginning of the course. The students would have to apply the “Green Skills” learned throughout the second course in the project. Thus, the students will be aware of the importance of caring for the environment in their future job. Nowadays, technology is continuously changing and for that reason a lot of new materials and electrical component appear in the market every day. New materials and components require new processes, and new processes require new skills.

Therefore, the policy makers have to check the skills and ‘Green Skills’ required by trainer and professional electricians in this time.

***Recommendation 3:*** Before the start of training, the trainer would have to make a test about the current technologies, new material and electrical components. In this way the policy makers could know if the trainers are up to day. In case a trainer does not pass the test, policy makers would have to provide information to do a refresher course. Once the trainers have completed the refresher course, they could take the test again.

This recommendation could be very important to “Green Skills” concepts because if the trainers are up to day in the technology scope, they will be able to teach their students what is the less damaging to the environment working way.

***Recommendation 4:*** Currently in Spain, all workers have to do a course about occupational risk prevention. This is a very good opportunity to speak about “Green Skills” to new electrician worker, therefore this course has to include a lesson about good environment practices. In the same way, the workers who have been working in the company for many years would have to do the “green course” even if they have taken the occupational risk prevention course.



The policy makers have to make sure that all electricity companies oblige their worker to take the “green course” of occupational risk prevention. Nowadays, the circular economy is a topic very popular in technology scope and the electrician profession have a very important role because the renewable energy is one of the most important things of the circular economy.

**Recommendation 5:** The renewable energy has to be one of the most important lessons in electrician training in the first and second courses. So, the trainers have to explain the importance of renewable energy in the circular economy. The electrician students have to know about renewable energy installations and the advantages or disadvantages of using the different energies, depending on application case. It is totally necessary that there is a specific subject about renewable energy for the second year. However, the renewable energy topic has to be a general part of first course, in this way every electrician will have basic knowledge about circular economy and “Green Skills”, which are much related to renewable energy. We consider that there are some topics related to environmental which are very important to electrician training. These topics should include in the curricula depending on the families to which they belong.

**Recommendation 6:** Eco-label is a “green skill” totally necessary for the electricians. For this reason, it is really important to include one subject about this topic in the electrical training. Eco-label is especially important in the electrical specialty because from the labelling, the workers will be able to know if an electronic component is dangerous for the environment really quickly. In the manufacturer of PCB (Printed circuit board) a lot of electronic component are used and some of them are very dangerous for the environment.

**Recommendation 7:** Ecological distribution of the towers in medium and high voltage networks. Often the towers are located in the middle of nature space or in the middle of the mountain. This fact has a great impact on the environment. So, the electrician students would need to study the best way to avoid high voltage tower in those places.

**Recommendation 8:** Smart-cities lessons should be included in the curricula of electrical training. The smart-cities are directly related to “green skills” because a smart-city is a city which is sustainable energetically. The smart-cities are surrounded by sensor networks and IoT (Internet of things) systems which provide information about the environment. If we have more information about the environment, we can act more effectively on it without causing damage. Thus, both smart-city and IoT topic have to be included like a subject in the electrician training, especially in the areas of training of renewable energy and electronics.

**Recommendation 9:** Home automated system has a great importance in the current electronic trend. That systems are related to “green skills” because they can transform a home in a more energy efficient way, therefore it will be more friendly with the environment. Nowadays, there is so much home automated system, but “energy harvesting system” is rising actually. Using the energy harvesting systems we can power supply to a sensor Networks without wires using the residual energy on the environmental in order to power supply low energy electronic components. These low-energy components normally are sensors. There a lot of residual energy on the environment, for example kinetic energy of the movement, electromagnetic energy of the antennas or Wi-Fi or even thermal energy.

**Recommendation 10:** Correct distribution of antennas or electromagnetic waves transmitter. The most recent studies show that the electromagnetic energy is dangerous for the people and the environment. For that reason, it is very important to include a subject about the dangerous of electromagnetic waves on the environment. In this way, the electrical students will be more aware about this topic and they can distribute correctly the antennas networks both in the city and the natural environment.



**Recommendation 11:** The electrical industry has a great impact on environment, so we should include in the curricula some recommendation about the location of industrial facilities. It is very dangerous that big transformers and converters are near the nature space because they can produce a fire if an accident occurs. For that reason, it could be a good idea include a lesson about safety protocol in special Dangerous situations. In this way the workers will know to act in case of an accident occurred.

## UK

### Introduction

This report is intended to raise awareness about the state of 'green skills' within vocational education and training (VET) for electricians( *This project focuses on entry-level (RQF/CQFW Level 2, SCQF Level 5) education for electricians within the construction sector, i.e. electrical installation qualifications which are currently available in the UK under Sector Subject Area (SSA) 5.2 'Building and Construction' (England, Wales, Northern Ireland) or Area of Competence 003: 'Constructing' (Scotland).* ) in the UK and to offer recommendations based upon work carried out in the "Green Skills at Vocational Education" project, funded in part by the European Commission. These recommendations are to be of interest to policy makers, VET professionals, VET trainers and other stakeholders.

For this project, teams from five countries (Italy, Romania, Spain, Turkey, and UK) agreed upon a pan-European working definition of 'green skills' which covers:

- environmental awareness
- expert knowledge on procedures for energy, waste, resource efficiency and sustainable development
- being practically involved in saving energy and protecting ecosystems
- being responsible for environmental management.

Recommendations are based upon three of this project's stakeholder interviews, survey results, and a review of the current state of the UK's vocational educational environment for 'green skills' (Landward Research, 2018a; 2018b; 2019). The recommendations are UK-orientated and cover three subject areas: vocational education and training (VET); regulations and standards; and wider policy.

### Recommendations: Vocational Education and Training

#### **Recommendation 1:**

*Continue to promote sustainability and construction as embedded concepts rather than separately. A consciousness of sustainable methods or materials and reducing waste should run through all aspects of training, rather than be seen as an add-on.*

- Several interviewed employers and educators highlighted how the term 'green skills' is used less in the UK than elsewhere in the EU. Stakeholders emphasised that sustainable methods should not be promoted not as an alternative or a 'green' way, but as a fundamental approach which runs throughout all working practices.
- In terms of established job roles, 'green skills' should be embedded in training rather than their own separate qualifications, so as to avoid proliferation of qualifications, which the *Whitehead Review of Adult Vocational Education in England* (2013) identifies as creating weaker links to occupational standard and a more complicated system overall.
- New T-Level courses (currently in design phase) should embed sustainable approaches throughout.

#### **Recommendation 2:**

*Beyond Level 2 (SCQF Level 5) vocational training, qualifications should provide learners with a better overview of how sustainability factors across entire buildings, so that electrical products and their*



installation better provide for the needs of other industries and do not negatively impact other sustainable approaches.

- The government has recognised the need to ensure 'holistic thinking' across electricity, heat, transport, construction sectors (UK Gov, 2017). For instance, electrical installers should have basic knowledge of electrical vehicles and their requirements, or how their work may impact insulation installation etc.

**Recommendation 3:**

*Level 2 (SCQF Level 5) qualifications should build upon their established introductions to renewable energy sources by introducing learners to other modern methods, products and trends in electrical installation. Modern methods should be reflective of current market demand and innovation, as per government policy and the guidance of the International Electro technical Commission (IEC).*

- Research into Level 2 (SCQF Level 5) qualifications found a consistent inclusion of introductory material concerning renewable energy sources (Landward Research, 2019). Beyond renewables, modern methods and process content could include:

- o electrical energy storage and 'Smart Grid' (IEC, 2018a)

- o smart houses, the 'internet of things', and wireless sensors (IEC, 2018b)

- o digital design systems for less waste and greater efficiency, such as BIM (BEIS, 2018).

- The Construction Leadership Council (CLC) stresses that the industry the capability to create demand by creating a 'narrative based on hard data' to 'encourage funders/lenders to procure for whole-life performance' (CLC, 2018). The government and product manufacturers must work co-operatively to encourage uptake.

**Recommendation 4:**

*Beyond installation, qualifications should re-evaluate their content for the maintenance of renewable resource products and micro generation.*

- Stakeholders identified a shortage of good maintenance services in the electrical sector.

**Recommendation 5:**

*Beyond the VET focus of this project, school pupils should continue to be taught general environmental consciousness and be made aware of the breadth of sustainable and innovative work within a career in the electrical sector.*

- Stakeholders identified the importance of early impact in making students aware of 'green skills' pathways within the electrical installation sector.

**Recommendation 6:**

*Beyond the VET focus of this project, there is scope to improve the sustainability and environmental awareness content on the continuous professional development (CPD) cycle.*

**Recommendations: Regulation and Standards**

**Recommendation 7:**

*Increase the implementation and scope of the Sustainable Building Training Guide for a better didactic framework for 'green skills'. The guide can be expanded to serve as a mandatory standard for 'green skills' inclusion at all education levels, including VET.*

- Educators surveyed for this project identified a lack of didactic framework amongst the greatest hindrances to their teaching of 'green skills'.

The CLC's *Sustainable Building Training Guide* (2017) identifies the principles of sustainable building for the development of learning content.



**Recommendation 8:**

*Standards for the installation of micro generation systems must be developed and enforced to ensure installations are performed to a high calibre. Such standards should become the basis of vocational education and training.*

- Stakeholders expressed concern that systems such as photovoltaic (PV) panels were being installed by individuals without qualifications or by individuals qualified in adjacent industries, for example double-glazing.
- The Construction Leadership Council (CLC) has identified a lack in consistent standards for how an asset's performance is measured, for the performance of suppliers and for measuring user satisfaction (CLC, 2018). Standards must be developed to ensure quality installation, a familiarity of which is introduced at entry-level education and training.
- Standards should operate at a national level, and make the difference between those trained by a manufacturer for a specific product and those with an overall skill.
- The Micro generation Certification Scheme (MSC), which stakeholders identified as especially expensive and bureaucratic for SMEs should be restructured in line with standards.

**Recommendation 9:**

*The competence of electrical installers and their training should be made more visible to employers and clients, matched against an improved national standard for micro generation. Waste management knowledge could become a requirement of working on a site through the required CSCS card.*

- Within building sites, there is scope to include 'green skills' aptitudes such as a knowledge of waste management and renewable energy generation on the Construction Skills Certification Scheme (CSCS) card.
- The *Each Home Counts Review* (2016) suggested a quality mark for installation, which is currently under consultation. A quality mark would improve the standards of installation, and as such create clearer aims for vocational education content.

Recommendations: Wider Policy

**Recommendation 10:**

*Better broadcast the industry's ability/determination to tackle environmental issues to address ingrained negative perceptions of the sector as well as problems with attracting young and more diverse workers.*

- The poor image of the construction industry as a whole was identified in the Farmer Review (2016) as negatively impacting entry into the sector as well as client relations. Schools should be involved in presenting a more holistic view of the industry for all abilities, which emphasise modern, digital, environmentally friendly and innovative working processes.
- Design... Engineer... Construct...! (DEC) provides a useful case study for how digital skills in the industry have been encouraged – and could provide a blueprint for environmentally sustainable design in the sector.

**Recommendation 11:**

*Encourage the recognition that 'green skills' greatly overlap with digital skills – a skills area currently being invested in. Digital technologies allow for more efficient building design, material use and reduction of waste.*

- The UK government is investing in new technologies, such as sensors, smart systems and materials into built assets (BEIS, 2018).
- VET learners should also be familiar with BIM, which is currently being promoted towards international partners to encourage mobility of skills and design (BEIS, 2018).



- Recommendations 5 of the *Farmer Review* calls for 'producing talent which is appropriate for a digitally enabled world' (Farmer, 2016), for which the Construction Industry Training Board has produced its own recommendations (CITB, 2018b).

**Recommendation 12:**

*Encourage the recognition that 'green skills' and their implementation create money-saving opportunities as well as environmental protection.*

- The National Infrastructure Commission (NIC) reports that renewables have become cost competitive (NIC, 2018) and the current government's Construction Sector Deal promises 'better homes that are cheaper to run' (BEIS, 2018).

- Vocational learners should be aware of the cost-saving potential of renewable sources and proper waste management. Several stakeholders suggested the benefit of being able to express money-saving opportunities at client or customer facing levels.

- The Whitehead Review (2013) identified too little emphasis on economically valuable skills in its review of adult vocational education.

**Recommendation 13:**

*Greater cross-party consensus must be reached in order to create long term agendas which avoid fluctuation, thereby giving businesses the stability and confidence to invest.*

- Government incentives such as the Green Deal and targets such as the number of zero-carbon homes have been pulled, creating a lack of confidence for investors.

- This recommendation reaffirms Recommendation 2 of the Westminster Sustainability Business Forum's (WSBF) 2015 *Building Better* report.

- The current government has committed to cleaner economic growth (BEIS, 2018).

**Recommendation 14:**

*At time of writing, the UK's planned exit from the European Union ('Brexit') has been delayed until 31st October 2019. The following recommendations concern the effect of the UK's exit from the EU, 'green skills' and vocational education.*

- **Recommendation 14.1:** As per the advice of the CLC, *prioritise the mutual recognition of qualifications across the UK and EU* (CLC, 2019) to ensure that the UK continues to attract the workers needed to keep up with demand. This government has pledged to become a world leader in the 'future of mobility' and must attract an estimated 1,570 new recruits into the electrical trades to meet demand over the next 5 years (CITB, 2019). Currently, 10% of the construction of buildings workforce is (non-UK) EU-born (ONS, 2018).

- **Recommendation 14.2:** As per the advice of the CLC, *lower the qualifications required to be a 'skilled worker' to NVQ Level 2*. CITB research (2018a) demonstrates that 80% of migrant workers would not qualify as skilled under the current requirements. Our research for this project demonstrated that Level 2 (SCQF 5) includes, at the least, general environmental awareness (Landward Research, 2019). If adjusted, Level 2 should include more practical waste management, building regulation and sustainable materials content.

- **Recommendation 14.3:** The UK government should align its own environmental and sustainability targets to that of the EU, to encourage the mobility of workers, goods and innovation as promised in the *Construction Sector Deal*. In particular, zero carbon homes – a policy cancelled by the UK in 2015 – has reportedly cost new home owners an estimated £58 million (ECIU, 2019). The UK should recommit to zero-carbon as per the European Commission 2050 long-term strategy (2018) in order to facilitate 'green skills' transfer and innovation.



## ITALY

### Introduction

Nowadays, we are standing at a great transformation that is taking place at international, national and local levels. The traditional growth strategies will not get us so far and they have inspired a new way in which modern societies deal with financial, climate and resource scarcity issues.

Today, new energy technologies and financial innovation have opened up new industrial and economic possibilities. Smart sustainable initiatives have led to job creation, innovation and local sustainable entrepreneurship. Highly efficient technologies and an intelligent cycle of materials coupled with workers reskilling and upskilling can stimulate a shift in our energy production and exploitation of environmental resources.

It is widely recognized that the opening to a green economy would lead to new frontiers in labour markets, highlighting the great growth prospects and the possibility of eco-Europe becoming a world leader in the industry sector, consequently creating opportunities for new jobs of quality.

The European Parliament in its resolution “Eco-innovation - and jobs growth through environmental policy” proposed special recommendations for a socially responsible transition towards high-quality green jobs. Member States should make use of the European Social Fund for programs aimed at up-skilling, training and retraining employees. The Commission and the Member States are invited to intensify their actions for the full implementation of the proposal in the context of the 2020 Strategy and to build a common vision on the different strategic opportunities that eco-innovation provides for the future.

At national level Member States are advised to develop strategies to align the skills of the workforce with the opportunities offered by the sector of green technology. This is by examining the different sub-sectors and their needs for skilled labour, recommending promotion of the creative and innovative potential of young people to contribute to sustainable development. “Green Skills” are seen as a relevant qualification for the European industry, not only for the sake of the environment but also as a European competitive advantage.

In this sector it is important on one hand the necessity of the best available technologies for energy reduction, the importance of reusable and biodegradable materials, but also on the other hand that this has to go conjointly with a human resources improvement of green skills and the awareness of green production and behaviour. It also embeds the involvement of the customers and their purchase decisions by improving their green awareness and the application of the green content to the whole learning chain (school - apprenticeship - higher technical education - continuous training - company).

### General recommendation

After a careful analysis of the Italian VET school curricula, we realized that the number of subjects that deals with green skills in the different courses is very high. These have specific programs that vary from region to region and also from institution to institution, both public and private.

More or less in any subject studied, from planning to training there is a part that concerns green topics.

However, In the curricula’s analysis what springs most immediately is that contents need more attention and must be studied in depth, specifically they need more practical moments.

In this regard, we suggest below some general recommendations that we want to propose after this careful analysis:



***Have a wide range of educational training offers in the field of green skills.***

The educational offer available in the VET training area is not very extensive.

The courses that are available in the electric sector gave to students the qualification of "Electric operator" or "Electronic operator" after having achieved three years and the qualification of "Electrical technician for industrial automation" or "Electronic technician" after having achieved a 4-year course.

In both curricula the current specialists are:

- Installer for civil and industrial electrical systems
- Installer of industrial automation systems
- Installer and maintainer of plants for sustainable energy production
- Civil / industrial electronic equipment installer

It is necessary create a wide range of educational courses that deal with green world.

***To address the need for the unskilled workers that have not been learned, at least the basic green skills during basic VET, due to age.***

The introduction of green skills in the educational training courses is quite recent. It is necessary to train or to reform all those professional profiles who have been working for years and have never learned basic green skills. It is useful to provide specific courses for these profiles to update them on recent green topics.

***Development of training offers based on market demand and in collaboration with other stakeholders in the construction sector and on the labour market.***

Before providing training courses, it would be necessary to consult the market demand in the electric and electronic sector.

It is well known that the supply and the demand for labour change considerably from year to year. We need to adapt the curricula content to the market supply to ensure that the new professional profiles are always up to date and in line with current job profiles.

***Encourage the increase of training courses for learning green skills in association with an accredited certification at least at national level.***

Nowadays we all know the importance of certification. Thanks to certifications it is possible to affirm that our activities have the minimum environmental impact and respect the environment. It is very important to enrich the training offer with courses that allow the study of various useful certifications in the electrical sector. It is necessary to know not only steps required of how to conduct a certification but it is necessary that after some years the learner can be a certifying professional with the skills required. This expedient means that the training offer becomes more attractive for future students and complies with the directives undertaken in the electrical-environmental field.

Some certifications on which it is possible to carry out an ad-hoc courses are:

LCA – The Life Cycle Assessment is used to evaluate a set of interactions that a product has with the environment, considering its entire life cycle that includes the phases of extraction and / or recovery of raw materials, production, distribution, use (therefore also reuse and maintenance), recycling and final disposal.

ECOLABEL - The Eco-label is used to certify the reduced environmental impact of the products or services offered by the companies.

IMQ-ECO - It is the Italian proposal of the IMQ (Institute of Quality Mark), which defines a Certification of Environmental Product Assertions. It serves to guarantee that the ecological characteristics declared by the manufacturer correspond to the truth and they are measurable and are maintained over time.



***Be informed and take into account the impact of Directive 2010/31 / EC and set measures that comply with the requirements.***

**Possible requirements on curriculums and training content for electricians**

Below are some more in-depth recommendations regarding the content of the curricula of vocational education courses in electrical sector.

It would be necessary within these courses to deepen, explain and analyze at best how to choose the materials and the electrical components not only in relation to the economic and functional aspect but above all the environmental one.

Moreover, all the technologies in the electric field that can help protect the surrounding environment and human beings should be deepened and catalogued.

It is important the elaboration of oriented strategies focused on the result of environmental protection in compliance with professional ethics and with reference to the current legislation. The knowledge acquired through the control and monitoring of a real electrical system should be put into practice. In this regard, tests and measurements in the laboratory should be increased, in order to identify and use tools and technologies suitable for the type of maintenance to be performed, respecting the workplace and the environment.

Furthermore, it would be necessary to introduce notions on how to identify feeding methods and the related environmental protections. Understanding how a condenser works as an electrical component, in order to predict its environmental sustainability.

To insert notions on how to improve industrial automation in relation to the work environment so as to have the least environmental impact with the least use of energy.

It would be necessary to introduce concepts on how to localize the structures of industrial plants so as to have the least impact on the environment.

To introduce notions on the protocol of action and safety in the automatic processes of special sensitivity. For example: plants that use nuclear energy, chemicals, etc. In this way, future workers will know how to behave in the event of an accident.

Deepen the certifications and labelling of electronic and electrical devices. From the label, workers will be able to know if an electronic component is dangerous for the environment in a faster and more intuitive way.

To introduce practical notions and workshops on the evaluation of the life cycle of electronic and electrical devices. Many electronic components or production materials, when they have a very long life, could become dangerous for the environment because they don't work properly. In the electrical and electronic field, it is necessary to study and introduce notions on device recycling. How these can be reused or in some cases disposed of through the correct recycling actions.

Introduce notions that highlight different energy saving solutions and systems. What are the most efficient energy management systems? The pros and cons of these, their use, their realization etc.

Concepts on the territorial planning of the antenna system. What are the effects of electromagnetic energy on the environment, or what are the dangers that the environment and human beings incur when they are in contact with it.

Introduction of concepts and practical sessions on how to reduce energy consumption by adopting energy saving conditions for the external lighting system.

Introduction and cataloguing of new technologies, especially those of sensors, which through energy systems, the sensors are independent of the power supply and therefore save energy.

In general it would be necessary to increase the study of the European standards in force as regards the construction and construction of both photovoltaic, wind, thermal systems etc. the related costs and incentives that it is possible to have, thus the electrical and electronic technician can also have consultancy skills in the field.



Another fundamental aspect is the propagation of the noise that the machines used often generate. On this, in-depth studies should be carried out in relation to current regulations and innovative technologies in relation to the environmental impacts they generate.

More generally, what could be improved or added is the increase in practical exercises on how to implement existing environmental solutions. It would be necessary to increase the sessions of the workshops and have a comparison with the reality by carrying out inspections on the spot.

In the end it is important to stimulate students in such a way as to have a greater awareness of climate change. Practical exercises to implement, evaluate and verify all the principles studied in the course. Practical examples of waste management with the implementation of an adequate awareness of the problem.

### **Possible requirements needed in trainers' skills**

As far as the trainers are concerned, they should be able to update themselves daily on news and directives in the environmental field and acquire skills that during their training career could not be acquired due to a lack of time, or a lack of preparation or because there was still no light on environmental issues.

The trainers should also follow not only the performance of the classic frontal lesson but could carry out their lessons with non-formal learning exercises, i.e.: brainstorming, follow-up, games, practical exercises, etc. in order to fully involve the student.

## **ROMANIA**

### **Introduction**

In August 2014 entered into force the Law no. 121/2014 on energy efficiency. The Law transposes the European Union regulations set out under Directive 2012/27/UE regarding energy efficiency, into national legislation. The main purpose of the Law is to establish a coherent legislative framework for the development and application of the national energy efficiency policy in order to achieve the national target for increasing energy efficiency.

In the context of national energy, sustainable development means ensuring energy demand, but not by increasing its use (excluding renewables), but by increasing energy efficiency, upgrade technology and restructure the economy.

In the strategy "Energy Efficiency trends and policies in ROMANIA" designed in 2015 by Romanian Energy Regulation Authority there is only one general remark on education: "Development of the national energy saving education programme for population, in schools and through mass-media, aiming at saving energy, protecting the environment and locally using the renewable energy sources". There is no reference to collaboration with the Ministry of Education in order to adapt the curriculum to the new requirements.

In Romania, according to the National Qualifications Framework, in the Electric field, at qualification level 3, there are defined 10 occupations for which professional training is made. The curriculum was designed according the Professional Training Standards related to the 10 occupations: Electrician for

construction, Electrician for mining exploitations, Electrician for ships, Electrician for low-voltage operations, Electrician for electrical and energetic equipment, Electrician for protection by relays, automation and measurements in electrical installations, Electrician for generating plants, stations and networks, Electrician for drilling-extraction equipment, Manufacturer of electro- technical products, Electrician for maintenance and repairs of household appliances.



In the project we referred to the Electrician in construction curriculum. Buildings represent about 40% of EU final consumption and 60% of electricity consumption. Electrician in construction is an occupation with maximum relevance for energy efficiency and the use of renewable energy sources in buildings. The Electrician in construction is executive and the proposals for implementing the green skills, must be strictly limited to its level of competences and decision-making.

The specific environmental protection rules norms are generally mentioned in the Professional Training Standards, focusing on waste management rules, recovery and reuse of materials, requests specific electrical building installations due to the environment.

In order to assimilate the green competences at the level of the occupation Electrician in construction, it is necessary to refer to the requirements of Directive 2012/27/UE regarding energy efficiency.

The curriculum references in environmental protection, efficient use of energy and the use of renewable energy sources in buildings are made in general terms without details. The learning content is at the decision of teachers, depending on their green skills training, which specifies that there is not enough learning material available to them and to students.

The knowledge about environmental protection, efficient use of energy is not grouped into "green" competences, their assessment is made within other specific competencies to the qualification, with a share of only 6%.

**For the development of green skills for electricians, we propose the following steps:**

- Establishing a coherent and flexible qualification framework for electrician qualifications to adapt easily to the dynamics of the labour market;
- Establishing a list of additional competencies relevant to environmental protection, energy efficiency and the use of renewable energy sources for each occupation in the construction field based on Directive 2012/27/UE regarding energy efficiency and Energy Efficiency trends and policies. We do not consider it necessary to set up new qualifications for green skills in electric field, but to introduce additional green skills for each existing qualification. It is important to identify the common green competences for the electricians and then the specific green skills for each occupation.
- Detailing of these skills through the abilities and technical knowledge required for each electric qualification.
- Completion of handbooks with concrete references to the ecological knowledge necessary for each electric qualification.
- Providing specific endowments for school workshops.
- Providing contracts for the students practice with companies that apply the regulations on Energy Efficiency and awareness of the practice enterprises regarding the importance of assimilation of green skills by students.
- Establishing an effective tutoring system for the students' practice at the practice enterprises and its monitoring.
- Training of teachers for teaching and assessment of general and specific green skills knowledge.
- Training of tutors from practice enterprises for teaching of practical knowledge to students and assessment of their assimilation.
- Continue collaboration with the practice enterprises in order to adapt the curriculum to the green skills dynamics.



- Including the green competences in the student assessment system according to Energy Efficiency trends and policies and increasing their share in the final grade. Assuring a certification for green skills for the graduates.
- Permanent information to increase the level of knowledge / understanding to stimulate the demand for green skills - environment protection, energy efficiency solutions and the use of renewable energy sources in buildings (consumers / investors and employers)
- Monitoring the results obtained through the degree of insertion into the labour market and the green buildings realized in the local area.

**In particular, green skills for electricians, ISCED 3 qualification level, refer to the following:**

- Recognition of the value of natural resources, biodiversity, energy, water, waste management. Developing a proactive attitude for the environment.
- Wise use of resources, in particular reducing the consumption of non-renewable natural resources of land, air and water and promoting a use related to real needs and not simply to consumer demand.
- 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 Use materials and thermal insulation technologies.
- Efficient use of energy and priority to increase the use of renewable energy sources (solar, wind, nuclear, hydroelectric, geothermal);
- Promoting the more efficient systems in terms of resource use: smart light bulb, smart plug, LED illumination, intelligent house and international wireless communication language called Z-wave.
- Use of recycled materials, re-use of existing materials: 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.
- Procurement of high performance electrical equipment and its maintenance.

### Content Based Recommendations for Each Country

We searched training content at partner countries and you can find our recommendations about the content here. Each country has different systems so we focused on some parts of electric education in partner countries. We mostly have chosen most popular and common education field in partner countries.

#### TURKEY

|   | <b>Recommendation that need to be included</b>  |
|---|---|
| <b>AC Motors, Control, Coil Methods</b>       | <p>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.</p> <p>Techniques that increase the efficiency of engines are important for energy saving. The methods and basic warnings to increase energy saving are necessary.</p> <p>Unit gives information about different types of engines. Engines shall be compared according to energy efficiency too.</p> |
| <b>Network Components and Network Systems</b> | <p>Network systems also consume electric. Warnings about minimizing energy consumption will be helpful.</p> <p>Info about what will be done with waste components and equipments is necessary.</p>  |
| <b>Smart Home</b>                             | <p>The units don't include information about the aftermath of the broken devices. There</p>   |



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| <b>Devices</b>                                    | shall be information about how these device sor components shall be demolished.   |
| <b>Elevator systems</b>                           | <p>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.</p> <p>Information about the potential pollution risks because of oil leakages shall be mentioned more because it is not risk for only the underground systems.</p> <p>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.</p>                        |
| <b>Printing machines</b>                          | <p>Warnings for energy saving needed.</p> <p>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.</p>  |
| <b>Multimedia equipments</b>                      | <p>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.</p> <p>Comparison between different models from the aspect of energy saving will be helpful.</p>   |
| <b>DC Motors<br/>Coil Methods</b>                 | 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.   |
| <b>Electric Machines and Control Systems</b>      | <p>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.</p> <p>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.</p>  |
| <b>Electric Engines</b>                           | Units mention about use of chemicals. There shall be warnings about not to use them unnecessarily.  |
| <b>Industrial Electric Systems</b>                | 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 that are expensive at the beginning. But these are perfect for big plants.   |
| <b>Energy Transfer and Protection Systems</b>     | 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.   |
| <b>Energy Production and Distribution Centres</b> | <p>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.</p> <p>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 effect to nature.</p> <p>Wind energy, wave energy, geothermal energy, solar energy are listed as nature friendly</p> |



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|  | technology. Nature friendly technology can also affect the nature. Units shall mention on these effects  |
| <b>Heaters and cooking Household Appliances</b>  | 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. |
| <b>Vocational Development</b>                    |  |
| <b>Refrigerators and Air Conditioners</b>        | Place of air conditioner affects the energy saving. Some information is needed about this.<br><br>The gases of refrigerators can be harmful for air. There shall be information about that.  |
| <b>Construction Electric and Powerful Plants</b> | 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.   |

## SPAIN

|   | <b>Recommendation that need to be included</b>  |
|---|---|
| <b>Industrial automation</b>                    | How to improve industrial automation according environment<br><br>Environmental considerations in the location of industrial facilities.<br><br>Action and safety protocol in automatic processes of special sensitivity. Ej nuclear energy, chemical products etc.   |
| <b>Electronics</b>                              | ECO certification and labelling on electronic devices.<br>Life cycle assessment on electronic devices.<br>Recycling of the electronic devices<br>Ecodesign in electronics<br><br>(PCB) "Print Circuit Board" Enviromental considerations in the manufacture of semiconductor components with chemical products such as sulfuric acid. |
| <b>Electrical engineering</b>                   | Environmental legislation on high and low voltage networks.   |
| <b>Indoor electrical installations</b>          | How to improve energy efficiency in indoor systems.<br>Take advantage of availale natural resources to minize the environmental impact.   |
| <b>Training and career counseling</b>           | Recommendation of doing a course of electrical efficiency and Ecodesigner in electricity systems  |
| <b>Electrical power distribution facilities</b> | Solutions and energy saving systems.<br><br>The most efficient energy managment systems.  |
| <b>Common</b>                                   | Ecodesign in Smart grids and smart cities.  |



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| <b>telecommunication infrastructures in buildings</b> | Effects of electromagnetic energy on the environment and considerations on the location of antennas.   |
| <b>Domotic installations</b>                          | Reduction of energy consumption.<br>Adaption to lighting conditions of the exterior.<br><br>Power the sensor networks with energy harvesting systems.                                    |
| <b>Solar energy photovoltaic installations</b>        | International and European environmental standard and directives on solar energy.<br><br>Enviromental considerations about authorized locations to distribute solar panel installations. |
| <b>Electric machines</b>                              | International and European environmental standard and directives on electric machines.<br><br>Level of noise allowed according to environmental legislation.                             |
| <b>Business and Entrepreneurship</b>                  | Bussiness related with environment in electricity and electronics  |
| <b>Formation in work centers</b>                      | Practical activities about electicity and electronics  |

## ITALY

|   | <b>Recommendation that need to be included</b>  |
|---|---|
| <b>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 ...)</b> | 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.   |
| <b>Technologies and techniques of installation and maintenance, (STANDARDS, ENVIRONMENTAL CERTIFICATIONS, MEASUREMENTS, CONTROLS, ROAD, APE, ENERGY CONVERSION, ETC ...):</b>   | 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. |
| <b>Technological laboratories, (PLANT DESIGN, ENERGY SAVING, HEAT, TEMPERATURE, CLIMATE,</b>  | 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.   |



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| <b>CLIMATE CHANGE, ECOLOGY, SPECIFIC HEAT, TRANSMITTANCE, ETC ...):</b>  |  |
| <b>Technologies and Techniques of Graphic Representation, (SOFTWARE, IDENTIFICATION OF ENVIRONMENTAL LABELS, DESIGN, DRAWINGS, ETC ...):</b>   | Knowing how to identify the power supply methods and related environmental protections.<br>Understanding the behavior of a capacitor as an electrical component, in order to predict its environmental sustainability. |
| <b>Mechanical Technologies and Applications, (RENEWABLE ENERGY, NON-RENEWABLE ENERGY, PHOTOVOLTAIC, EOLIC, GEOTHERMIC SYSTEMS, ENERGY TRANSFORMATION, STANDARDS AND APPLICATIONS, ETCC ...):</b> | Practical execution of the knowledge gained on renewable energy while respecting the environment, through experiments or workshops   |

**UK**

| <b>Level 2 IVQ Diploma in Electrical Installation</b>                         |   |
|---|---|
| <b>UNIT</b>   | <b>Green Skills Content Recommendations</b>   |
| Electrical Installation: Safety at Work                                       | 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: Calculations, setting out and Drawing                | Environmental case studies could be used in examples for drawing/calculations/setting out.  |
| Electrical Installation: Practical skills                                     | 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 <sup>21</sup> ) and green inspection standards such as BREEAM. |
| <b>Level 2 Diploma in Electrical Installations (Buildings and Structures)</b> |   |
| <b>UNIT</b>   | <b>Green Skills Content Recommendations</b>   |
| Unit 202 Principles of Electrical Science                                     | This unit deals with the mathematical and scientific principles of electricity. Environmental case studies could be used in example material.   |



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|---|---|
| Unit 203 Electrical installations technology  | 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 210 Understand how to communicate with others within building services engineering | Key terms of environmental issues could be examined in order to improve communication with different groups.  |
| <b>City &amp; Guilds Level 2 Technical Certificate in Electrical Installation</b>       |   |
| <b>UNIT</b>   | <b>Green Skills Content Recommendations</b>   |
| Unit 202 Electrical Science   | This unit deals with the mathematical and scientific principles of electricity. Environmental case studies could be used in example material.   |
| <b>EAL Level 2 Diploma In Electrical Installation</b>                                   |   |
| <b>UNIT</b>   | <b>Green Skills Content Recommendations</b>   |
| Electrical Installation Methods, Procedures and Requirements                            | Key terms of environmental issues could be examined in order to improve communication with different groups.  |
| Electrical Installation Craft Skills  | 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  | This unit deals with the mathematical and scientific principles of electricity. Environmental case studies could be used in example material.   |

## ROMANIA

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

| The module                     | Recommendations   |
|--------------------------------|---|
| <b>General technologies in</b> | -Selection of the waste from modeling, mechanical and physical treatment of metal surfaces and plastics |



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| <b>electrotechnics</b>   | <ul style="list-style-type: none"> <li>-Selection of packaging waste in electric field</li> <li>-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.</li> <li>-Information about reusable materials in the electric field</li> </ul>  |
| <b>Components of electrical equipment</b>                                  | <ul style="list-style-type: none"> <li>-Selection of the waste from modeling, mechanical and physical treatment of metal surfaces and plastics</li> <li>-Selection of packaging waste in electric field</li> <li>-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.</li> <li>-Information about reusable materials in the electric field</li> </ul>   |
| <b>Electric measures for continuous current and in alternating current</b> | <ul style="list-style-type: none"> <li>-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.</li> <li>-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</li> </ul>   |
| <b>Electric devices</b>  | <ul style="list-style-type: none"> <li>-information about smart light bulb, smart plug</li> </ul>   |
| <b>Electric machines</b>   | <p>Information about:</p> <ul style="list-style-type: none"> <li>-the operating principle of the electrical generators using renewable sources</li> <li>-alternative energies more accessible and more efficient: how resources are used alternatives (solar, wind, nuclear, hydroelectric, geothermal) for energy generation.</li> </ul>   |
| <b>Electrical installations specific to buildings</b>                      | <p>Information about:</p> <ul style="list-style-type: none"> <li>- calculating the energy requirement in a household and design of a solar energy system based on this need.</li> <li>- LED illumination Energy efficiency, Lighting quality and visual comfort, Concept and aesthetics</li> <li>-"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.</li> <li>-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 from manual orders via phone or tablet, which can trigger simple on / off scenarios or programmed in the same way of such conditions.</li> </ul> |
| <b>Electrical installations for solar panels</b>                           | <ul style="list-style-type: none"> <li>-information on the efficiency of solar panels</li> </ul>  |



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