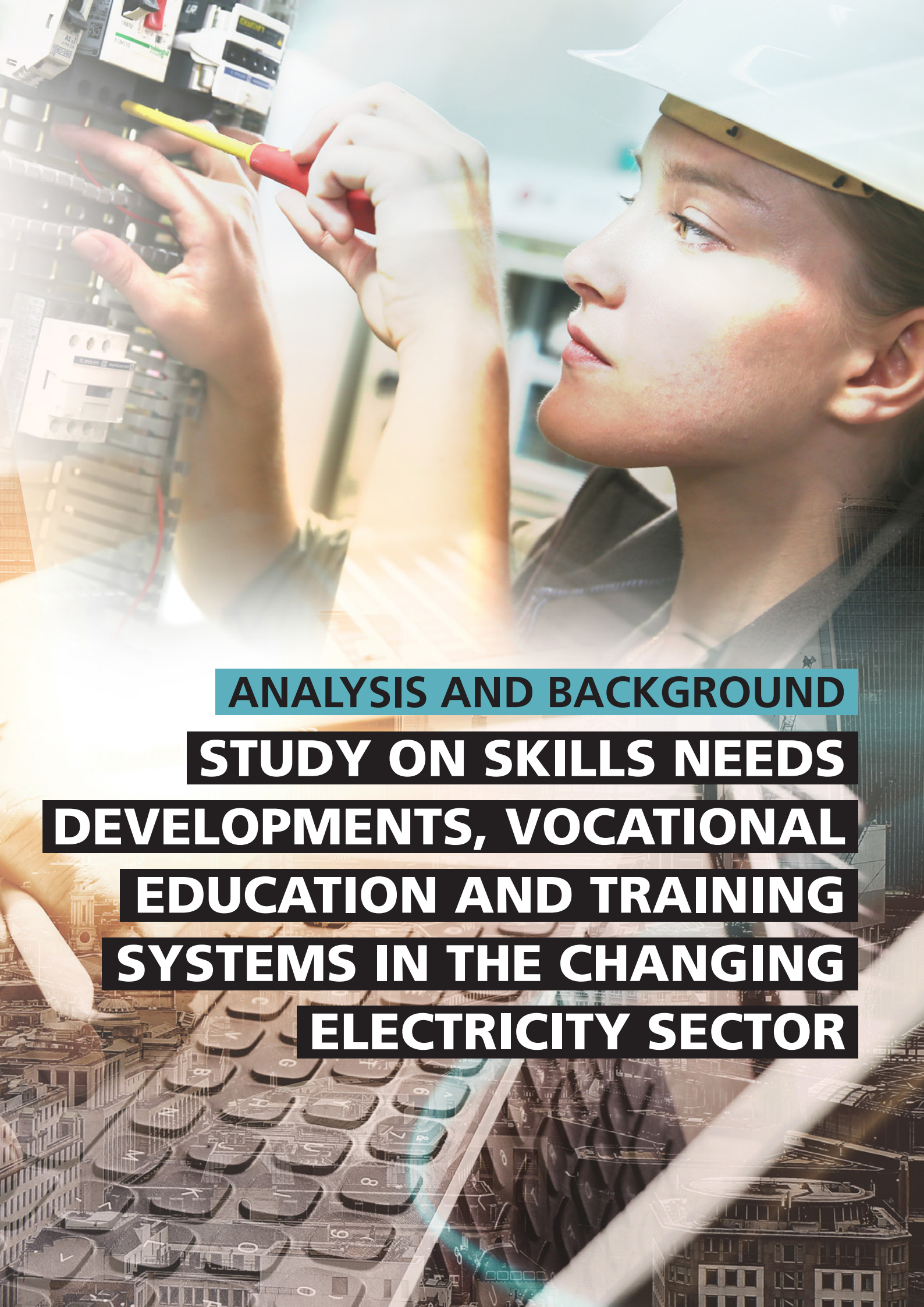

ANALYSIS AND BACKGROUND

STUDY ON SKILLS NEEDS DEVELOPMENTS, VOCATIONAL EDUCATION AND TRAINING SYSTEMS IN THE CHANGING ELECTRICITY SECTOR

Project Consultant

Spin360

Sustainability | Progress | Innovation | Network

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Spin360 supports companies, industrial associations, social partners and institutions in taking advantage of the opportunities for a development model based on prompt and ongoing anticipation of changes. The pillars on which the growth models we propose are based are: Sustainability, Progress, Innovation and Network, with a broad 360-degree approach.

With the support of the European Union

1. FOREWORD

The European social partners for the electricity sector—industriAll European Trade Union and the European Public Service Union (EPSU), representing the trade unions, and Eurelectric, representing the electricity-sector employers—have identified the skills needs for the electricity sector and education and training systems as a priority for their joint work. There are several drivers motivating these priorities. Firstly, the ongoing transition of the electricity sector driven by the decarbonization and the digitalization of the sector and the skills required by new technologies and business models. Secondly, high youth unemployment in Europe: the situation of young people in the labour market, and especially the transition of young people from education to the labour market, has been identified as a priority.

The mitigation of climate change coupled with digitalization of the sector will have a serious impact on employment. It will result in shifts in employment and job profiles that need to be addressed urgently. Education and training systems will have to provide for the skills that our sector needs in order to respond to these shifts. Our joint understanding and cooperation to promote a Just Transition to clean-energy systems within the EU is based largely on the skills dimension. Moreover, Europe has recently witnessed an economic and financial crisis, the effects of which were especially severe for young people. In many EU countries, young people who wanted to enter the labour market were faced with unemployment or precarious working conditions. We have addressed this problem in our Joint Agreement on a Quality Framework for Traineeships in the European Electricity Sector, which provides for good working conditions and standards for young people in traineeships.

These considerations led us to carry out an EU-funded project to study the drivers of change in the electricity sector, their impact on job profiles, the diversity of education programmes in Europe and, ultimately, to identify best practices. With this, the resulting study, it is our ambition to contribute to the discussion and offer best practice or solutions that could be replicated across the EU. What is more, the study and its recommendations have led us to develop a roadmap in which we define the key areas in the field of skills, qualifications, education and professional development that we need to address as European social partners in the coming years. It includes some very specific commitments for the European social partners as well as for social partners at national, sectoral and company level.

It is our ultimate objective to offer an attractive work environment and quality employment—built on a well-educated workforce who contribute to growth, prosperity and quality employment in the entire European economy.

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CONTENTS

2. EXECUTIVE SUMMARY

2. EXECUTIVE SUMMARY

SKILLS NEEDS DEVELOPMENTS, VOCATIONAL EDUCATION AND TRAINING SYSTEMS IN THE CHANGING ELECTRICITY SECTOR

BACKGROUND

Though electricity systems vary significantly across EU member states, the European electricity system is everywhere changing rapidly.

The most visible developments are in electricity production, with the growing penetration of small and medium renewable plants, meaning that network systems will need to develop and become better integrated. Developments in storage technologies will also be an important part of future systems.

Digitalization, smart metering systems and rapid technological developments of control, information and communication technology mean that energy suppliers will have new opportunities in the market. It will be a market environment where the competitive value of services will depend on new relationships with customers who are becoming more aware of their choices in energy consumption.

Changes underway in the sector have created both new opportunities and new challenges. Opportunities include new workforce potential in the renewable energy sector, especially in information and communication technologies; challenges include the skills gap in the deployment and operation of new technologies and the need for a qualified young workforce.

This *Skills Needs Developments, Vocational Education and Training Systems in the Changing Electricity Sector Report* is the result of an extended study and seeks to understand the following trends:

- Current and future impact, in a timeframe of 10 years, of drivers of changes in occupations in terms of skills needs.
- Current Vocational Education and Training (VET) offer, focusing on new skills needs in the sector.
- Skills mismatches and gaps between skills needs and the current VET offer.
- VET best practice in the electricity sector.

The recommendations included in the report represent an key outcome of the present study and aim to assist the European social partners in the development of a Roadmap on Skills in the Electricity Sector, which is an integral part of their ongoing work to harness the energy transition.

METHODOLOGY

This study has been shaped and developed in collaboration with the European social partners in the electricity sector: EPSU, industriAll Europe and Eurelectric and the members of the project Steering Committee. This has been done with a view to promoting the integration of young people through an updated skills offer in the electricity labour market.

Research tools: three extended surveys and three regional seminars

Timeframe of activities: 13 months (May 2017-June 2018)

Target audience of the surveys:

- 184 stakeholders from leading European employers and trade-union federations in the electricity sector
- 188 VET providers in the electricity sector in 23 European countries

SCOPE

In 2016, "electric power generation, transmission and distribution" generated a turnover of € 1.152 trillion throughout the EU-28, accounting for almost 13% of total EU-28 GDP.

"Trade in electricity" is the most relevant sub-sector in the total turnover, accounting for nearly 47% of the total in 2015. Meanwhile, "electricity transmission" is the least important in terms of turnover with only 6% of the total share.

The study targeted all EU-28 member states. The results are therefore associated with this geographical framework. However, since the research focuses on the sectoral workforce, emphasis has been given to the 11 EU countries that account for more than 80% of the total European workforce in the electricity sector (Fig. 2.1).

KEY FINDINGS FROM THE RESEARCH

The study highlights high expectations among respondents that certain drivers of change will impact on occupations in the sector: more than 50% of respondents replied positively for 10 out of 15 occupations in the sector (Tab. 1) and digitalization and technological changes will pose the greatest challenge to the workforce in the sector, as compared to decarbonization and new business models (Fig. 2.2).

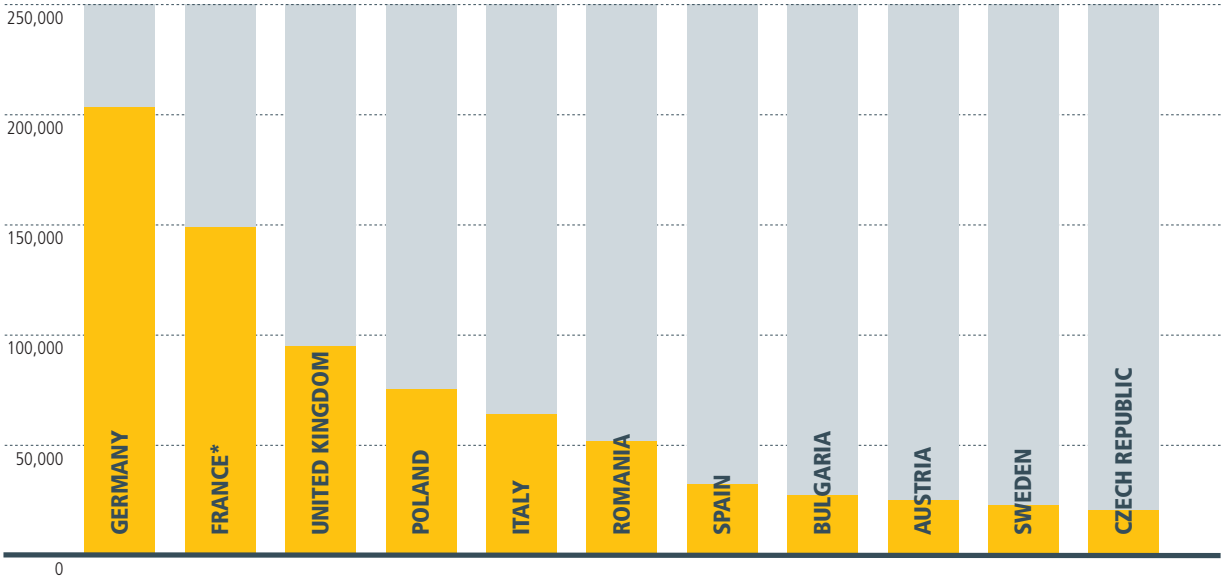
Network and Household Metering Technicians, Engineers and ICT specialists are the occupations with the highest expected impacts (Table 2.1).

In the next ten years, occupations in the sector will require new and updated skill sets to meet the challenges posed by the energy transition and climate change.

Our research explicitly asked respondents which skills they expected to be in most demand for a set of fifteen occupations. The skills identified by respondents mainly belong to the following three categories: "technology-digital" (40%), "soft skills" (22%) and "specialized technical skills" (16%) (Fig. 2.3).

FIGURE 2.1

COUNTRIES THAT ACCOUNT FOR 80% OF PEOPLE EMPLOYED IN THE INDUSTRY "ELECTRIC POWER GENERATION, TRANSMISSION AND DISTRIBUTION" (No, 2015)



Source: Elaboration on Eurostat data (Nace D351) * 2014 data

FIGURE 2.2

MAIN DRIVER OF IMPACT ON OCCUPATIONS

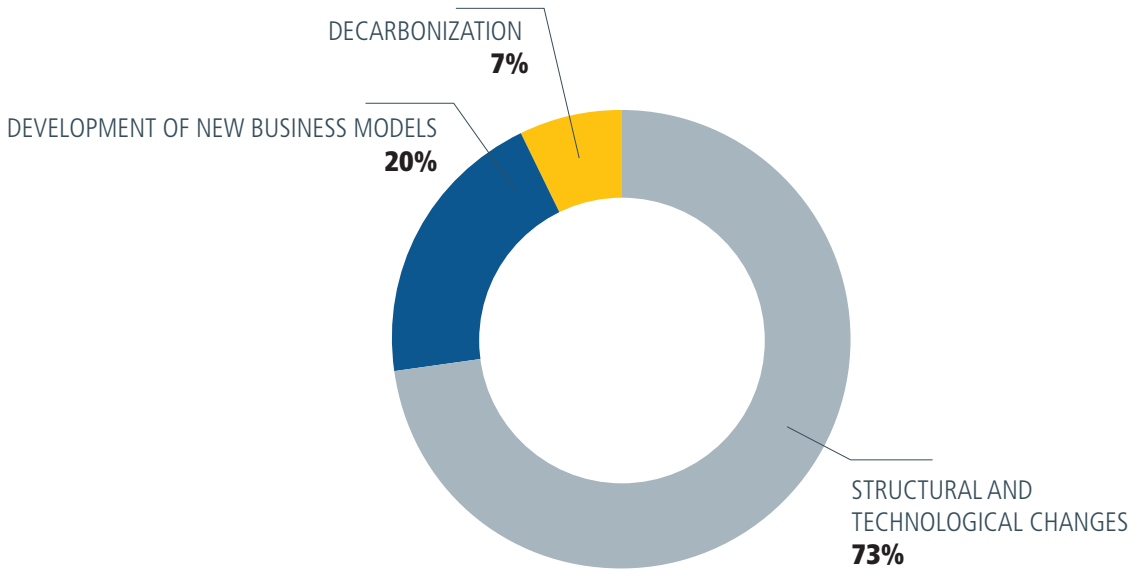


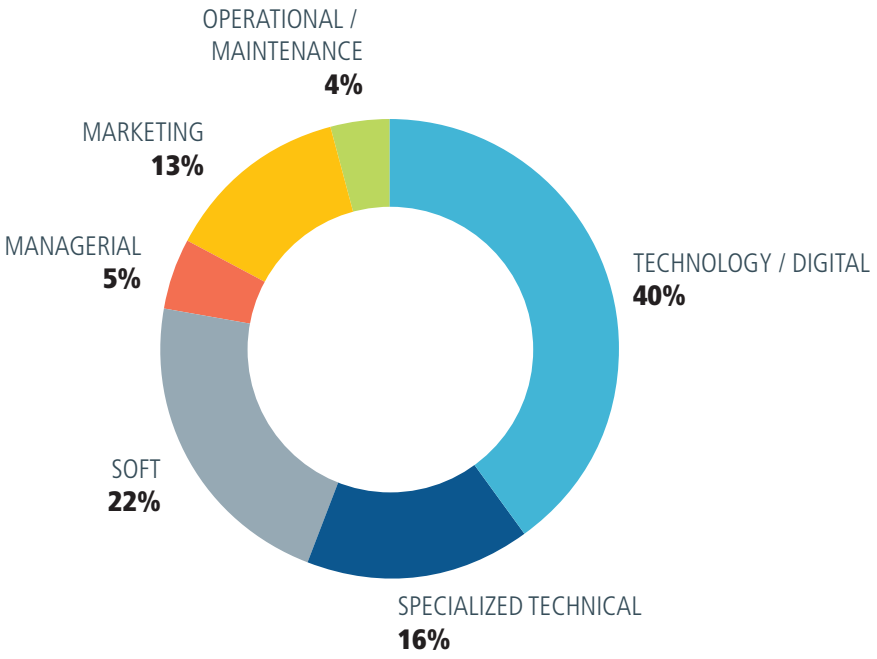
TABLE 2.1

	OCCUPATION	MAIN DRIVER OF IMPACT	IMPACTS OF DRIVERS ON OCCUPATION
1	O&M: NETWORK-ELECTRICIAN	STRUCTURAL AND TECHNOLOGICAL CHANGES	79%
2	O&M: HOUSEHOLD METERING TECHNICIAN	STRUCTURAL AND TECHNOLOGICAL CHANGES	77%
3	O&M: FACILITY-TECHNICIAN	STRUCTURAL AND TECHNOLOGICAL CHANGES	64%
4	ENGINEER: PLAN.& DEVELOP., PRODUCTION AND MAINTANANCE OF ELECTRICITY GEN. FACILITIES	STRUCTURAL AND TECHNOLOGICAL CHANGES	67%
5	ENGINEER: NETWORK	STRUCTURAL AND TECHNOLOGICAL CHANGES	77%
6	ENGINEER: STORAGE	STRUCTURAL AND TECHNOLOGICAL CHANGES	64%
7	PROJECT MANAGERS AND BUSINESS DEVELOPERS	STRUCTURAL AND TECHNOLOGICAL CHANGES/NEW BUSINESS MODELS	54%
8	COMMERCE & TRADING: SALES MANAGER/ OPERATIVES AND SALES EMPLOYEES	DEVELOPMENT OF NEW BUSINESS MODELS	51%
9	COMMERCE & TRADING: CUSTOMER RELATIONSHIPS & SERVICES	DEVELOPMENT OF NEW BUSINESS MODELS	46%
10	ASSSET ENGINEER/MANAGER	STRUCTURAL AND TECHNOLOGICAL CHANGES	46%
11	ENERGY EFFICIENCY ADVISOR	DECARBONIZATION	51%
12	ICT SPECIALIST: BIG DATA ANALYST	STRUCTURAL AND TECHNOLOGICAL CHANGES	49%
13	ICT SPECIALIST: ICT TECHNICIANS	STRUCTURAL AND TECHNOLOGICAL CHANGES	44%
14	BACK-OFFICE EMPLOYEE	DEVELOPMENT OF NEW BUSINESS MODELS	44%
15	NETWORK OPERATOR AND DISPATCHER	STRUCTURAL AND TECHNOLOGICAL CHANGES	56%

Source: Elaboration of data from project research activity

FIGURE 2.3

FORECASTED SKILLS NEEDS IN NEXT 10 YEARS
CATEGORY DISTRIBUTION



Source: Elaboration of data from project research activity.

According to the responses, an overall set of 45 skills (22 "most needed", 23 "new skills"[1]) were identified as required in order to match the changes underway in the sector.

The Internet of Things is expected to have the greatest impact on occupations amongst those identified as "new skills", followed by Automation and Artificial Intelligence, Smart-Grid Knowledge, and Cyber Security (Fig. 2.4).

GENERAL TRENDS IN SKILL DEVELOPMENTS OVER THE NEXT TEN YEARS

National social partners generally agreed on the growing importance of soft skills for all occupational categories, especially for Installation and Maintenance occupations, which are expected to be largely replaced by machine and technological/digital developments. As such, soft skills would provide these workers with a competitive edge over machines and technological/digital developments in the sector. Furthermore, the digitalization of the sector, together with the growth of internet-based applications are progressively changing the sector, both on the supply and the demand sides. This process leads to increased demand

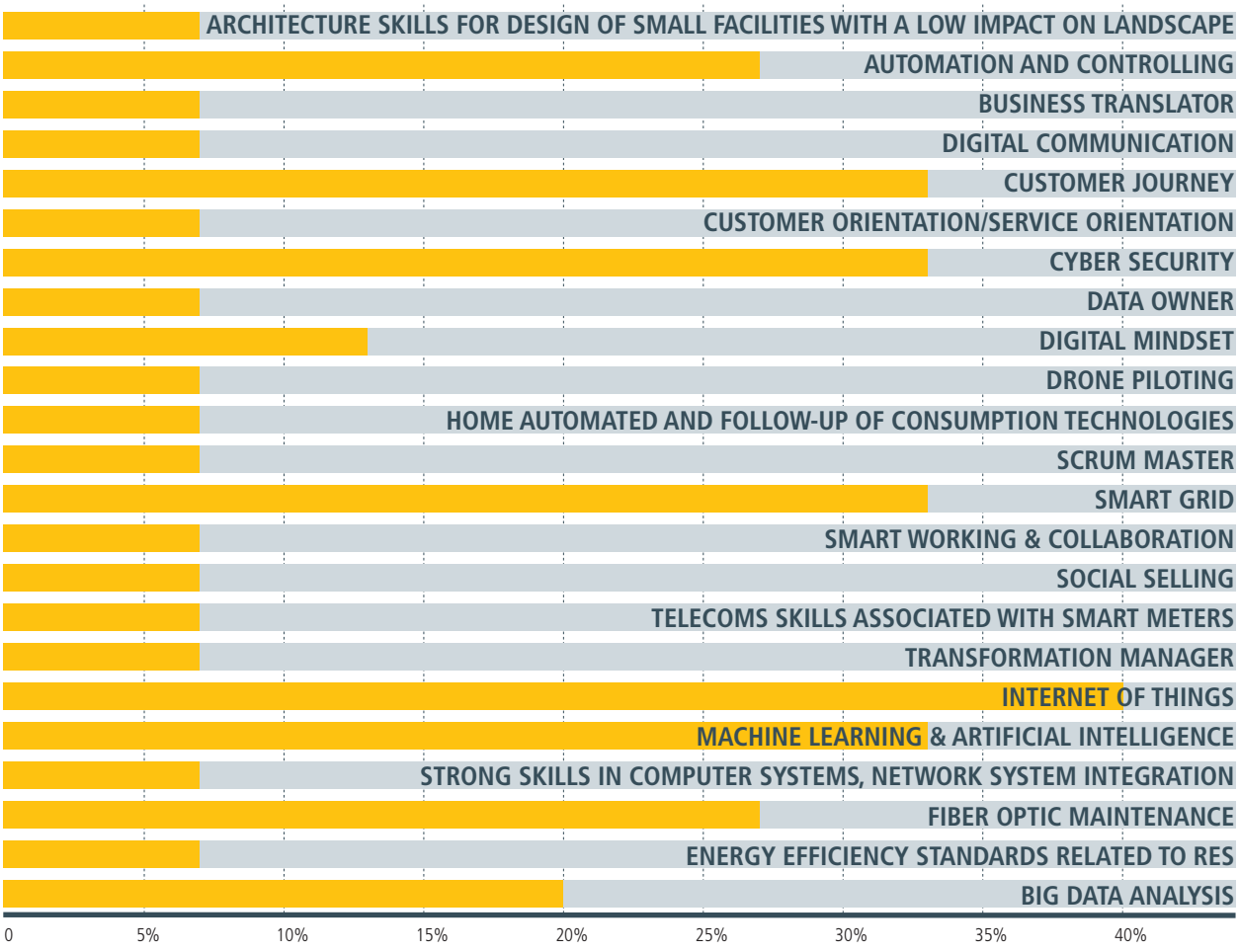
[1] The elaboration of the survey results considered a first set of relevant "more needed" skills from pre-given response options and a second set that were self-specified by respondents as "new skills".

for ***data analytics*** and telecommunication skills ***(Internet of Things, advanced computer skills***) that are relevant to nearly all occupational categories.

The skill forecast that can be drawn from the research aligns to the overall employment trends as identified by national social partners. Specifically, these are the transition from blue-collar to grey collar jobs and from grey-collar to white-collar jobs.

FIGURE 2.4

REPRESENTATIVENESS OF NEW SKILLS IN OCCUPATIONS



Source: Elaboration of data from project research activity.

FORECAST FOR SKILL DEVELOPMENTS BY OCCUPATIONAL CATEGORIES

TECHNICIANS, INSTALLATION AND MAINTENANCE OCCUPATIONS

According to the project results, technicians are expected to become multi-taskers with an adequate set of soft skills. Facility Technicians will need more social and relational skills to facilitate direct relationships with customers in a decentralized generation system where end-consumers also own small generation facilities connected to the grid. Technicians are also expected to acquire technological/digital skills such as ***drone piloting***, that will be used for maintenance activity, as well as skills relating to ***machine learning and artificial intelligence***.

ENGINEERING OCCUPATIONS (PLANNING & DEVELOPMENT, FACILITY AND NETWORK ENGINEERS)

Energy storage, ***smart grid*** and ***renewable energy technologies*** are specialized technical skills that will be in greater demand amongst engineering occupations over the next ten years, according to the respondents. Those working in these professions will also need ***digital skills*** associated with ***big-data analytics***, the ability to collect and analyze data from the grid and metering systems, and ***automation & controlling*** skills.

ICT SPECIALISTS (BIG DATA ANALYST, ICT TECHNICIAN)

ICT professions are cross-sectoral occupations which will gain increasing relevance in the new energy market. More of these professionals will be required to build knowledge on ***data security*** and ***data ownership***, in order to mitigate the risks of cyber attacks and manipulation of energy tariffs/electric data as well as to safeguard privacy and security.

NETWORK OPERATORS AND DISPATCHERS

Network operators and dispatchers are highly skilled specialists that ensure the distribution and transmission of electricity through network systems. Workers in these roles will need to acquire advanced digital and technology skills (***automation and controlling***, ***big data and advanced analytics***) to control and detect evidence of operating problems in the network. Soft skills such as ***logic, critical*** and ***anticipating competences*** are expected to be in greater demand in these occupations. These specialists will need to be able to identify the strengths and weaknesses of alternative solutions or approaches to problems.

PROJECT MANAGERS AND BUSINESS DEVELOPERS

Office-based work is expected to require more soft skills in comparison with other occupations. Office workers in the sector will need to demonstrate a variety of personal competences to adapt to changes in energy-sector business models. "Project Managers" will have to develop new competences and skills associated with the digitalization of the electricity system, be able to use the amount of available data to take competitive advantage and develop innovative customer-oriented services besides just electricity supply.

ENERGY EFFICIENCY ADVISORS

The expectation is that Energy Efficiency Advisors will need more specialized technical skills in ***storage technologies*** whilst being able to use and interpret a wide set of electrical data flow from a more decentralized energy system.

COMMERCE AND TRADING, ASSET ENGINEER AND BACK-OFFICE OCCUPATIONS

As with Project Managers, cross-cutting occupations such as Commerce & Trade, Asset Engineer and Back-Office are expected to require more soft skills such as ***creative & entrepreneurial thinking*** and ***innovation capacity*** but also ***customer orientation*** skills due to changes in business models that offer services with an increasing level of interaction with end-users.

THE VET SYSTEM IN THE ELECTRICITY SECTOR

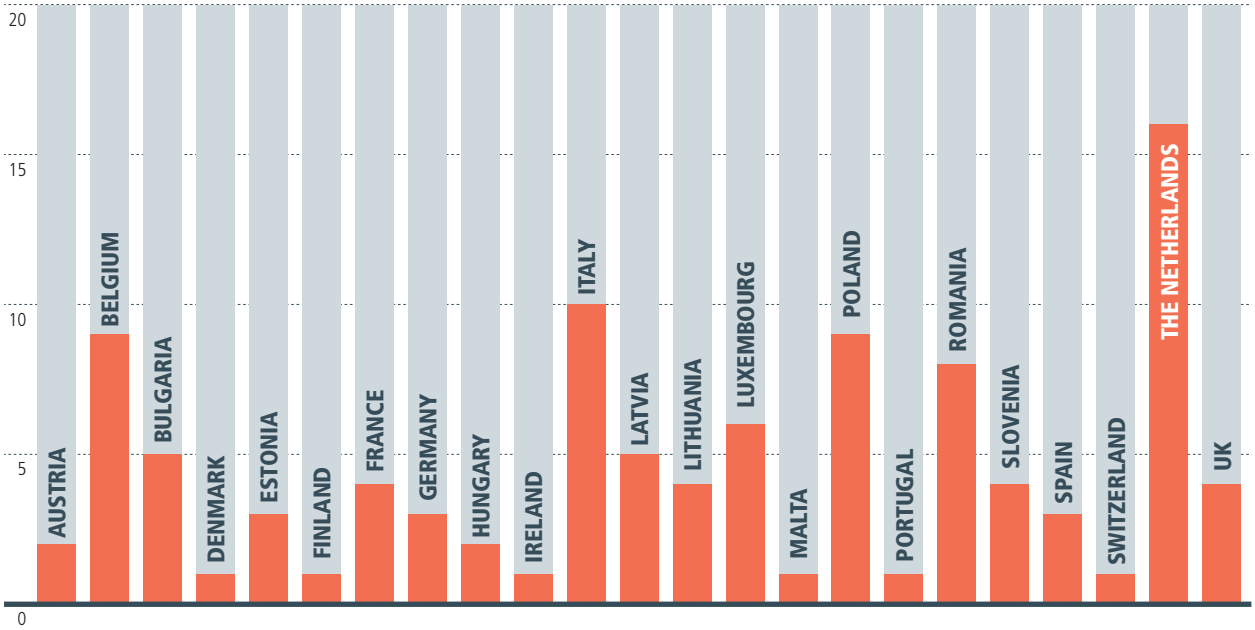
As a first step in the research activity, 188 representative VET providers in the electricity sector were mapped in 23 European countries (Fig. 2.5).

Vocational Education and Training (VET) in the electricity sector varies from one country to another: vocational education can be offered in full-time schools or within the framework of the dual system using, for instance, the apprenticeship. This is a recognized and successful form of work-based learning as it eases the transition from education and training to work and contributes to lower levels of youth unemployment by ensuring a greater degree of future employability. One ongoing challenge for maintaining the electricity-industry workforce is the amount of time required to train new workers; the European electricity workforce is educated through a variety of means but work-based learning methods such as apprenticeships and internship programmes are shown to be the most effective training approach in the electricity sector.

FIGURE 2.5

VET PROVIDERS DISTRIBUTION IN THE ELECTRICITY SECTOR

(%)



Source: Elaboration of data from project research activity.

What is clear from the information collected during the regional project seminars is that leading energy companies have implemented their own apprenticeship programmes due to a lack of uniformity in standards and qualifications. This has made it difficult to ensure that applicants have the necessary skills. Some good examples from energy companies are described in the Best Practice section of the report.

GAP ANALYSIS – VET OFFER AND FUTURE SKILLS NEEDS

Identifying the gap between future expectations on skill developments was a key task for this study.

According to the overall responses of VET providers, the current offer in education and training matches the demand for future skills needs for only 39% of the total skills analyzed.

Commerce and Trading came out as the occupational category with the highest imbalances in the VET offer. This means that the educational programmes relevant to this category are not effectively responding to the forecasted skills needs. After these, Back-Office employees, Operation and Maintenance, and ICT Specialists are the occupations with the highest imbalances (Fig. 2.6).

When analyzing overall results from a skill category perspective, "technology - digital skills" is the category with the highest gap in VET offer, nearly twice as high as the average value. "Specialized Technical" skills don't present gaps but imbalances are high due to an overestimated VET offer.

The overall picture of how VET providers are responding to the "new skills" needs in occupations is more concerning, especially for "marketing and technology - digital" skills.

The current VET offer does not yet appear to have included this new skill set in their educational programmes. In the survey of VET providers, we listed the new skills in a pre-given set of options and asked teachers which skills were included in the programme. Nearly 60% of the skills had a response rate below 25%.

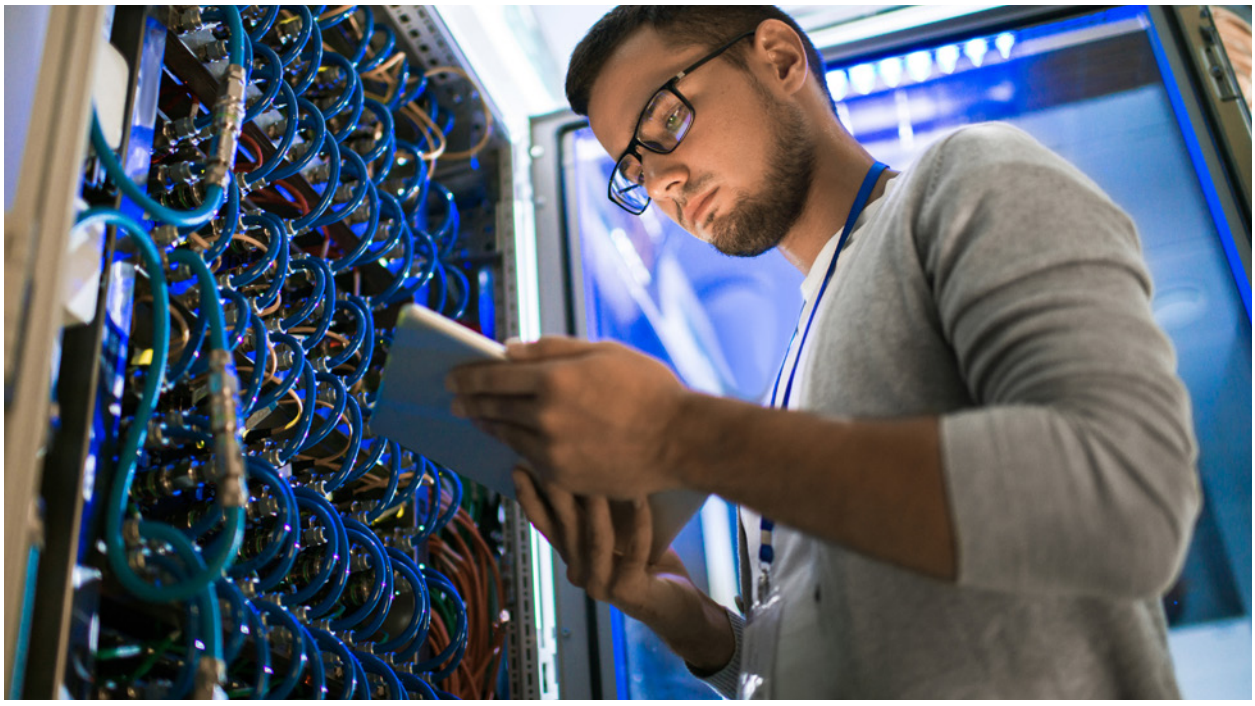
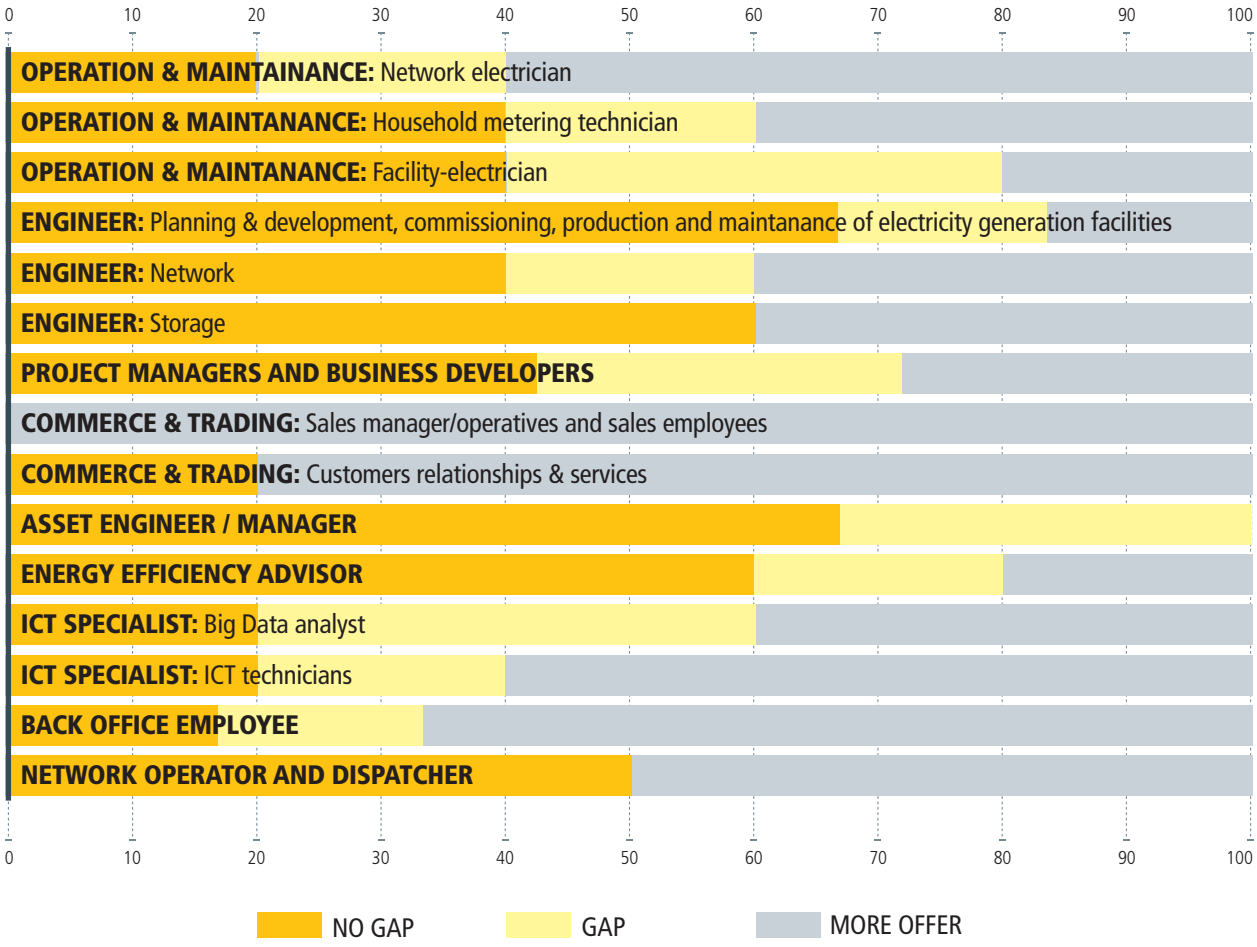


FIGURE 2.6

SKILLS NEEDS AND VET OFFER: MATCH ANALYSIS BY OCCUPATION
(%)



Source: Elaboration of data from project research activity

POLICY RECOMMENDATIONS TO EUROPEAN SOCIAL PARTNERS

The importance of this report lies in its strategic potential to orientate the actions and programmes of European social partners in the electricity sector towards the development of a Roadmap on Skills.

In order to to be useful in this endeavor, this research includes a set of five recommendations that integrate the main outputs from the discussions amongst the national social partners. Moreover, it is important that the recommendations provided represent the framework for implementation of prioritized actions during the following years of activity.

TABLE 2.2

Nº	BRIEF DESCRIPTION OF THE RECOMMENDATIONS
1	**STRENGTHEN THE ROLE OF SOCIAL PARTNERS IN THE INTERACTION WITH VET PROVIDERS:** Regional seminars and research activity made clear the need to strengthen collaboration between VET providers and national social partners. Capacity building should focus on updating the curricula of education and training programmes in the electricity sector in order to meet the future skills needs of the industry.
2	**MAINTAIN AND UPDATE SECTORAL INTELLIGENCE ON SKILLS NEEDS, IN ORDER TO PERIODICALLY REVISE STRATEGIES AND ACTIONS**: In order to be able to periodically orient the work of VET provision in updating curricula, EU social partners would need to maintain, at EU level, sectoral intelligence on skills needs as required by the changing electricity market.
3	**SYNTHESIZE BEST PRACTICES IDENTIFIED DURING THIS PROJECT AND DEFINE PRACTICAL APPROACHES AND CAPACITY-BUILDING PROJECTS IN ORDER TO SPREAD THEM ACROSS EUROPE:** EU social partners should harness those elements of best practices identified as effective in the report, as well as those from other sectors, to implement projects at a national level.
4	**DEVELOP A SECTOR SKILLS ALLIANCE AIMED AT IDENTIFYING AND IMPLEMENTING KEY ELEMENTS ON SKILLS (AMONG OTHERS QUALIFICATION AND RECOGNITION SYSTEMS):** Recognition of skills and competences within a multi-country and multi-system European electricity sector is crucial to tackle the skills shortages in occupations. These shortages arise from drivers of change that the electricity sector is undergoing but their solutions can create value through education and training activities in companies.
5	**DEFINE AND IMPLEMENT A SYSTEMATIC STRATEGY TO IMPROVE THE ATTRACTIVENESS OF THE SECTOR TO POTENTIAL EMPLOYEES:** There should be a systematic approach in place to compete with other sectors to attract skilled young workers. Other sectors are already implementing strategies aimed at communicating sectoral job opportunities and sectoral values. The electricity sector must compete with these.

VET BEST PRACTICES

Part of the research activity developed during the study was aimed at identifying what is being done in terms of innovative tools in VET systems. It also sought to highlight effective national and regional training programmes, methods to monitor skills needs and address skill mismatches and gaps.

28 best practices were identified by stakeholders in the survey and eight of them were selected in the report. They belong to the following categories:

1. Meeting labour-market skills needs in education and training
2. VET systems: quality and adequacy of programmes
3. Work-based learning methods, apprenticeships

TABLE 2.3

CAT.	COUNTRY	ORGANIZATION/NAME	SHORT DESCRIPTION
1	Spain	*National Reference Centers (CRN)*	National Reference Centers (CRN) are public centers for innovation and experimentation of vocational training for the professionals in the electricity sector. There are two centers: one for engineers and the other for renewable energy in Navarra. They are a main reference point for professional education.
1	Netherlands	*Stichting Blei Foundation*	A public-private collaboration of the eleven regional education centers, or ROCs, which are structurally active in the vocational qualification, with a broad representation of network companies and contractors. The current learning resources are adapted to the requirements of the new vocational qualification.
1	Bulgaria	*CEZ Group Academy* For university students	CEZ Group is an established, integrated electricity conglomerate with operations in a number of countries in Central and South-Eastern Europe and Turkey, headquartered in the Czech Republic.The Academy provides training and seminars to the students studying in the field of energy and utilities in order to introduce them to the realities of the energy and utilities sector and to attract them to the company (generally as interns).
2	Malta	*Malta College of Arts, Science and Technology (MCAST)*	Established in 2001, the Malta College of Arts, Science and Technology (MCAST) is the country's leading vocational education and training institution. MCAST and the Reggie Miller Foundation (the educational body of the General Workers' Union) run tailor-made courses for employees and employers. Reggie Miller can accredit courses up to Level V.
2	Germany	Dual system for craft workers	Germany's apprenticeship system provides 344 certified trained occupations, designed by the government and industry. The average apprenticeship period is 36 months. The average age of a graduate-apprentice is 22. Apprentices are on average 19,5 years old when they begin their vocational training. The remuneration paid by the company is approx. one third of the salary of a skilled worker.
2	Switzerland	The ***Swiss VPET System***	The provision of VET and professional education is a mission collectively shouldered by the Confederation, the cantons and professional organizations. These partners are jointly committed to the highest possible standard of quality ensuring the skills are updated in line with market demand.
3	Italy	The school-work model: apprenticeship at ***ENEL,*** Italy	The ENEL apprenticeship model was regulated by a collective agreement between the company and trade unions that covered contractual and economic conditions and rights. The apprenticeship programme implemented was a three-year path during the 4th and 5th years of high school, followed by professional training in the company over the following 12 months for the students who achieved the diploma and a level of qualification deemed appropriate by the company.
3	France	Apprenticeship programmes with ***EDF Group (EDF, ERDF, EGDF, RTE)***	The Group prioritizes apprenticeships through work-study contracts to promote social advancement and recruit new employees at every level of qualification. The commitments in the Professional Training Agreement (Défi Formation) testify to the group's plans to develop apprenticeships in France.

3. INTRODUCTION

3. INTRODUCTION

STUDY OBJECTIVES

This study aims to achieve the following objectives:

- Deepen the knowledge of skills relevant to future developments in the sector, which will come from drivers of changes such as digitalization, new business models and decarbonization
- Identify new skills needs, skill developments and skills mismatches in regards to the VET offer
- Provide an overview of current Vocational Education and Training (VET) systems,
- Provide policy recommendations on how European and national social partners can manage this change in their roadmap of activities on education and skills for the upcoming years as a means to ensure a qualified workforce in the changing electricity sector.
- Identify VET best practices in member states that bring the world of education and work closer together and reduce skills mismatches at sectoral level.

By evaluating future labour-market needs in the sector, in terms of new skills required, from the perspective of some of Europe's largest employers and the relevant trade-union organizations, we hope to improve current knowledge and enhance partnerships at a European and national level between educators, training providers, workers and employers. The aim is to better manage the impact of the revolution taking place in the sector in terms of employment, skills and education.

STRUCTURE OF THE REPORT

This report consists of four parts with the key findings of our research.

Part I explores the future employment offer in the European electricity sector, at least over the next 10 years. It touches, firstly, on the expected impacts of three drivers of change— decarbonization of the sector, structural and technological changes and new business models. It then reviews the expected impact on the demand for new skills and competences for 15 representative occupations.

Part II Explores VET systems across Europe in regards to electricity providers, with a focus on national peculiarities.

Part III of the report presents our findings on the current VET offer with a focus on the skills needs identified in our research activity (as described in Part I). It will scrutinize whether the present education systems reflect the structural transitions the sector is undergoing.

Finally, **Part IV** identifies best practices in VET systems across Europe.

BACKGROUND

Electricity systems vary significantly across EU member states. All face different challenges and have different starting points posed by the impact of the drivers of changes that we identified for this study. However, viewed as a whole, the European electricity system is already undergoing a rapid transformation.

The most visible developments are in electricity production, with the growing penetration of small and medium renewable plants, mainly wind and solar, which provide the grid with variable and intermittent energy. Network systems will need to develop and become better integrated, making optimum use of all available sources, whilst expanding capacity as needed in a timely manner.

Less visible, but no less important, is the development in storage technologies. These are likely to be an important part of future systems. They will have to manage the variability in electricity production and in the network systems.

Digitalization, smart-metering systems and rapid technological developments of control, information and communication technology, also pose challenges and open the way for new approaches to system management, more flexible demand and new business models. Suppliers will gain new opportunities in the market where the competitive value of services will also be measured by redefined relationships with customers.

On the other hand, end-consumers will no longer be just passive recipients, becoming more active in the energy market and more aware of energy consumption. Newcomers in the energy market (aggregators and energy-services providers) will seek to take advantage of these developments.

While these changes hold great promise for sustainability and future prosperity, many of them also pose major challenges to the sector's workforce, which will require a wide array of new skills. Changes underway in the sector have created both new opportunities and new challenges. Opportunities include new workforce potential in the renewable-energy sector and information and communication technologies; challenges include the skills gap for deploying and operating new technologies and the need to recruit and retain a qualified young workforce. There is also the need to retrain and re-qualify older workers whose existing jobs are likely to disappear.

The electricity sector's full potential will only be realized if its workforce is able to appropriately adapt and evolve to meet future needs. To this end, Vocational and Education Training (VET) systems have a crucial role to play. They bear the responsibility for adequately training young workers who want to enter the sector and provide them with the required skills and competences.

DECARBONIZATION OF THE SECTOR

In 2015, the energy sector[2] in the EU-28 was responsible for 55% of total EU-28 greenhouse gas emissions[3]. In 1990, the sector was an even greater source.

Studies considering economy-wide reduction goals in greenhouse-gas emissions consistently envision the electricity sector as the linchpin of efforts to reduce greenhouse gas (GHG) emissions. This sector is expected to make faster reductions, and on a greater scale, than other sectors of the economy such as transportation, heating, agriculture, and industry.

Policy initiatives have aided the implementation of better energy efficiency and renewable energy, with a view to decarbonization in different parts of the world. In December 2015, 195 countries adopted the first ever universal, legally binding global climate agreement[4], the success of which will largely depend on the energy sector. It will need to decarbonize its energy sources and its energy models.

The EU Commission has led the way on the international issue of climate change. In 2008, it set what at the time was the most ambitious policy framework with the *2020 EU energy and climate package,* a set of directives with not binding targets on energy efficiency and renewable energy quotas for each member state. According to the latest report by *Eurobserv'er*, 11 countries have already achieved them[5]. In 2011, the EU confirmed its non-binding political commitment to reduce GHG emissions by 2050 by 80-95 per cent compared to 1990 levels. Current EU policies and frameworks such as the recent *EU Clean Energy Package* set new binding targets to be reached by 2030: -40% CO_2 reductions at a national level, +27% renewable energy sources (EC baseline) and +30% energy efficiency.

In order to reach these goals, the energy sector has a crucial role to play and would need to cut emissions nearly to zero while expanding to electrify (and consequently decarbonize) portions of the transportation, heating and industrial sectors[6].

Multiple studies that explore 100% renewable electricity systems for achieving deep decarbonization of the sector (chiefly through wind and solar generation) indicate that it is technically possible (and more

[2] The energy sector, as indicated in the IPCC Guidelines, mainly comprises: exploration and exploitation of primary energy sources, conversion of primary energy sources into more usable energy forms in refineries and power plants, transmission and distribution of fuels, use of fuels in stationary and mobile applications.
[3] Reports of annual greenhouse gas inventories from the European Union (EU) to the United Nations under the United Nations Framework Convention on Climate Change (UNFCCC)
[4] Conference of the Parties of the UNFCCC, the Paris Agreement signed by the Nations commits to achieve carbon emissions neutrality between 2050 - 2100
[5] The state of renewable energies in Europe, Eurobserv'er, 2016
[6] Roadmap 2050: a practical guide to a prosperous, low carbon Europe, 2010.

cost effective than the existing system)[7]. But decarbonized power systems dominated by variable renewables are physically larger and require much greater total installed capacity. A recent study conducted by the Reiner Lemoine Institute[8] presents a scenario for decarbonizing the European power system by 2050 (achieving 98.4% below 1990 emissions levels) that relies heavily on an expansion of wind and solar energy; the total installed capacity in this scenario is 4.2 times larger than the peak demand with a consequent environmental impact on land use.

Despite economic and political factors, which can speed up or impede the process, the leading European stakeholders in the electricity sector seem to be on the right track and have committed to leading the global low-carbon economy in order to meet the commitments made in the Paris Agreement.

STRUCTURAL AND TECHNOLOGICAL CHANGES IN THE SECTOR

The electricity sector is facing several fundamental structural and technological developments that are changing the overall energy system.

- Decentralized energy production: the energy transition is moving towards a system where big energy facilities will be replaced by smaller ones, mainly sourced from renewable energy, and where power will be generated close to where it is consumed, increasing energy efficiency and reducing energy transmission losses. Even though the transition is largely dependent on economic and political drivers, according to KPMG research, there is expected to be an increasing trend towards decentralized energy production that will require a higher integration of energy-generation systems[9].

- The deployment of smart grids: the future of energy systems is represented by modern electrical power infrastructure and a flexible system which can incorporate the large and growing number of decentralized renewable sources, enabling two-way flows of electricity. The network will incorporate smart control systems that execute, monitor and prevent electrical outages or blackouts and provide real-time information on the demand side.

- Long-duration battery storage technologies: to cover the variability and intermittency of renewable-power generation and store the energy produced during off-peak time. Battery storage is likely to be an important part of future systems. The technologies have been developing rapidly in recent years and costs have come down to near commercial levels.

- Automation and controlling, telecommunication and Internet of Things (IoT) and big data analytics are progressively changing almost all sectors of the economy. The digitalization of the electricity sector is an ongoing process both on the supply and the demand side. Utilities are deploying vast networks of advanced metering infrastructure, commonly called smart meters. However, according to PwC's 2015 Global Power & Utilities (P&U) Survey they still do not appear to achieve the full potential that should come with big-data analysis.

The rise and adoption of big data and internet-based applications are making systems more intelligent and interactive, altering habits on the demand side and stimulating the rapid development of new business models developed by providers, start-ups and companies in adjacent fields.

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[7] Global Energy System Based On 100% Renewable Energy - Electricity sector, Energy Watch Group and Lappeenranta University of Technology, 2017

[8] How to meet EU GHG emission reduction targets? A model based decarbonization pathway for Europe's electricity supply system until 2050, G.Pleßmann, P.Blechinger, 2017

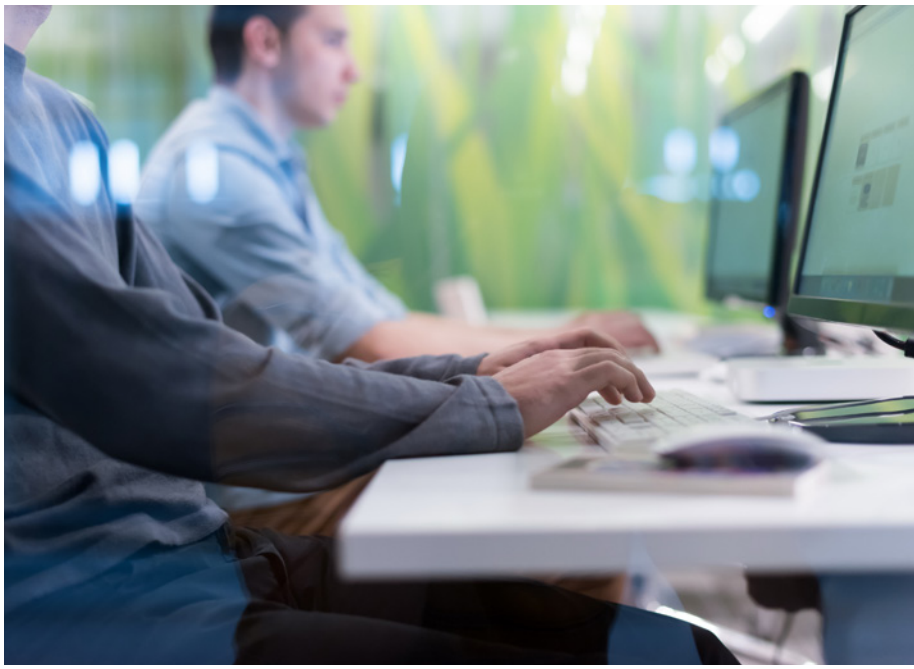
[9] Decentralized energy industry: Opportunity or threat to energy companies?, KMPG,l 2015

DEVELOPMENT OF NEW BUSINESS MODELS IN THE SECTOR

The era when energy suppliers could be considered mainly kilowatt-hour providers is passed. Following the liberalization of the market, new players have progressively entered markets, competing to offer new services and adopt new energy-supply models to end-consumers. This trend will probably continue as newcomers enter a market whose transformation is marked by its increased rapidity.

At the same time, traditional barriers to market entry have changed. New energy companies no longer need to own lots of infrastructure—their competitive advantage is based on other values and competences such as processing power and the marketing of goods.

Interaction with end-users is increasing with the development of information and communication technologies such as apps on mobile devices, on-line portals and live-chat functions. With the digitalization process, such trends are only set to deepen. Suppliers will have access to more data on end-user's profiles and be able to provide "high-orientation" services such as real time consumption data, potentially appliance-by-appliance, provide benchmarks and advise on energy-efficiency measures.



Furthermore, on-site interventions will become less frequent and be replaced by remote actions and online services.

On the other hand, consumers are no longer passive recipients: from being dependent energy users, they are becoming actors in the market, energy storers and energy producers, either individually (as consumers) or collectively (organized in small energy communities). Furthermore, awareness of energy efficiency is increasing and consumers are more interested in value-added services beyond energy supply.

In the mid-term, future consumers will be able to choose from a wide array of potential power sources, with a big share of renewable-energy services, and use online technologies to achieve greater autonomy and be more aware of energy use.

RESEARCH QUESTIONS

This research will investigate the following questions:

RQ1: *What are the skills and competences required by the labour market to successfully support the changes in the electricity sector over the next ten years?*

RQ2: *What is the current training and educational system in the electricity sector in member states?*

RQ3: *Does the current vocational education and training offer in EU member states meet expectations for the new skills forecast?*

RQ4: *What are the VET best practices in place in EU member states*?

SCOPE, LIMITATIONS AND RESULTS REPRESENTIVENESS

As a first consideration on the scope of the research study, it is important to clarify that the research doesn't include the quantitative forecasting of occupations such as the creation of new job categories or the replacement of existing ones.

Furthermore, the study focuses on changes in the sector due to three main drivers of change (decarbonization, structural and technological changes and new business models) whilst other relevant drivers such as economic, demographic or social trends do not fall into the scope of the study.

INTERPRETATION OF RESULTS: SAMPLE COVERAGE AND REPRESENTATIVENESS

Given the report's aim of providing guidance and stimulating discussion, it is important to treat with caution the extent to which it is possible to generalize from our findings. A first consideration on the representativeness of the results derives from the response rate to the surveys: 23% across 17 Countries for the first survey on skill developments and 13% distributed in 13 Countries, for the survey on VET offer. The difficulty of obtaining responses may be due to a variety of reasons including the time "cost" of completing questions for all 15 sectoral occupations and the difficulty in reaching the person within the organization with an in-depth knowledge of sectoral developments and human resources, or, in the case of the survey to VET providers, the head of the educational programmes.

A second consideration on the representativeness of results of the research is due to the uneven number of responses received per-country and to the fact that replies don't cover all EU28 countries. In this case, the difficulty of obtaining responses from some geographical ar-

eas, despite the dedicated work by experts and the support of European social partners, might be the different starting points posed by the impact of the drivers of changes and therefore different levels of interest in research objectives.

Our target countries comprised of all EU-28 member states, therefore results should be associated with this geographical framework. However, since the research focuses on skill developments in occupations, focus has been made on those 11 EU counties that account for more than 80% of the total European workforce in the electricity sector.

The background analysis on the scope of the research is therefore provided in the following paragraph which briefly describes the industry and provides employment data for the electricity sector.

THE ELECTRICITY SECTOR: BASIC ECONOMIC AND STRUCTURAL DATA

The electricity industry in the Eurostat Database is labelled as "Electric power generation, transmission and distribution" (Nace D351) and is comprised of the following sub-sectors:

- "Production of Electricity" (Nace D351.1)
- "Transmission of electricity" (Nace D351.2)
- "Distribution of Electricity" (Nace D351.3)
- "Trade of electricity" (Nace D351.4)

In 2016, "Electric power generation, transmission and distribution" generated a turnover of €1.152 trillion throughout the EU-28, accounting for almost 13% of total EU28 GDP.

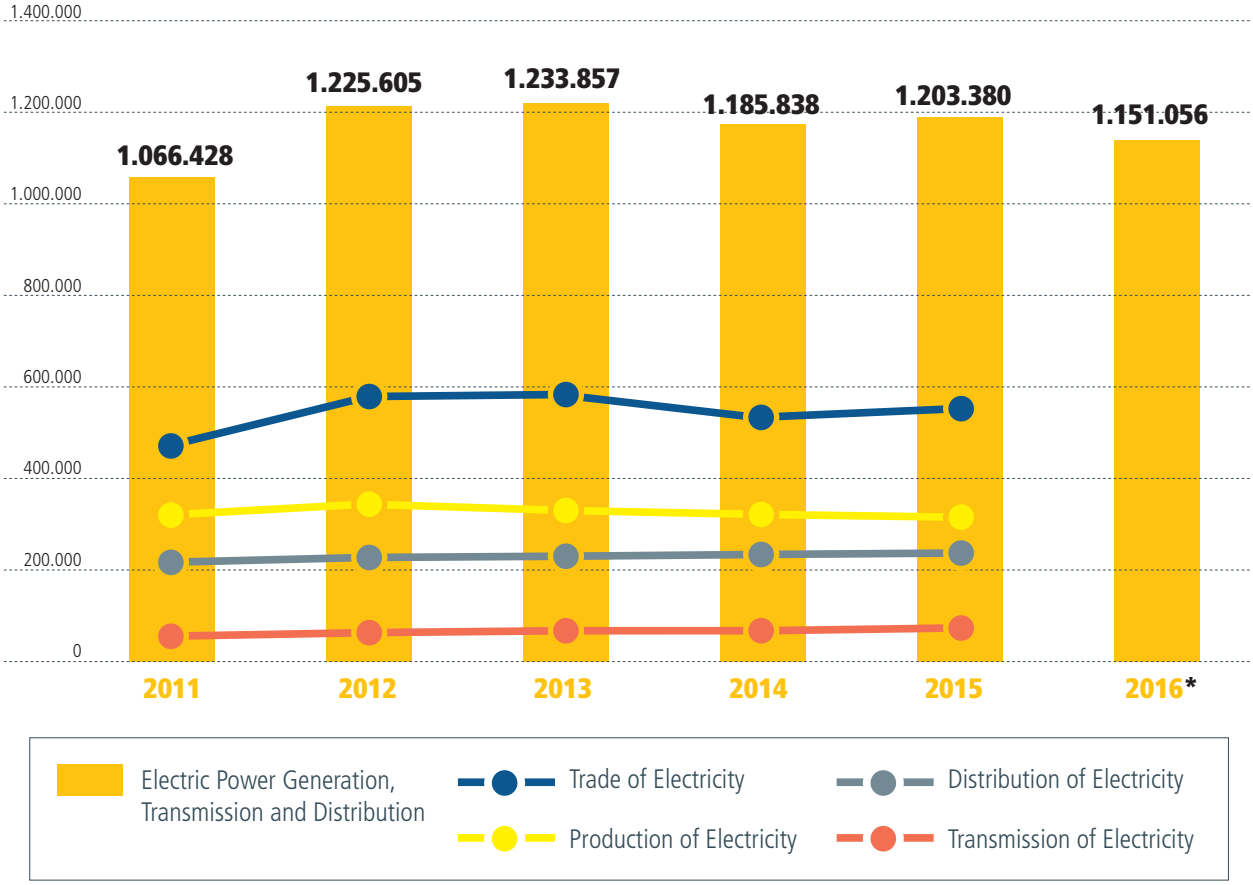
"Trade of electricity" is the sub-sector with the greatest relevant weight in total sector turnover, accounting, in 2015, for nearly 47% of the total, while "Transmission in electricity" is the least important in terms of turnover with only 6% of the total share (Fig.3.1).

Germany is the country that accounts for the by far the highest total turnover of the "Electric power generation, transmission, distribution" with € 476,117 million in 2016 (Fig.3.2).

FIGURE 3.1

TURNOVER OF THE INDUSTRY "ELECTRIC POWER GENERATION, TRANSMISSION AND DISTRIBUTION"

(MILLIONS OF EURO)

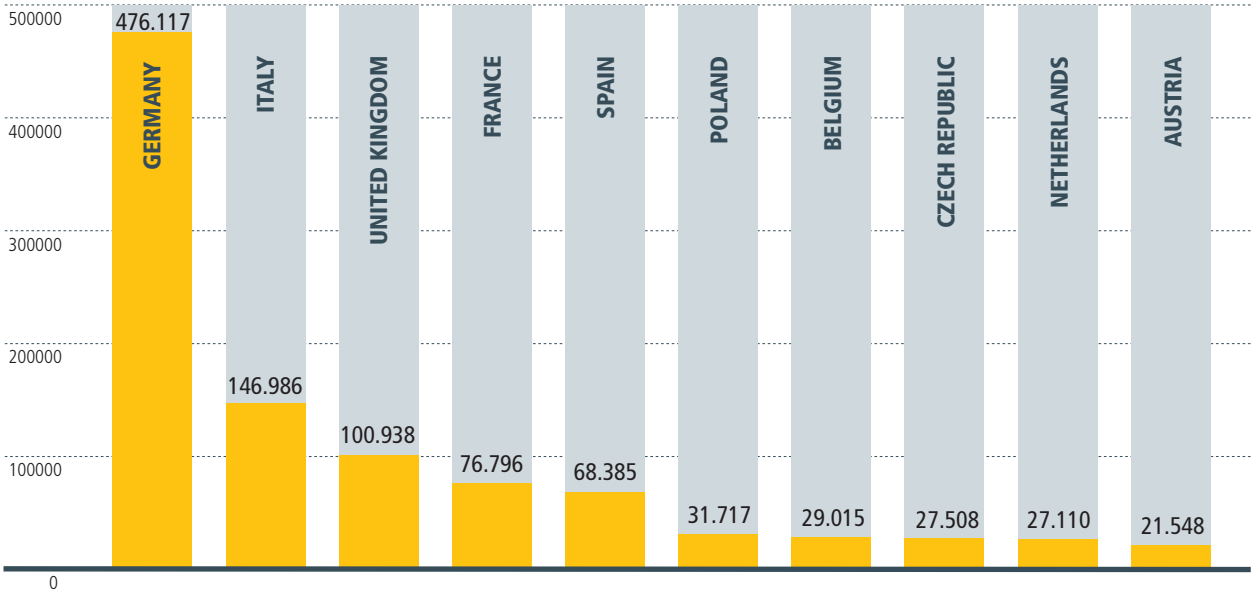


Source: Elaboration on Eurostat data (Nace D351) * Partial data from subsectors not available for 2016

FIGURE 3.2

TOP TEN COUNTRIES - TURNOVER OF THE SECTOR "ELECTRIC POWER GENERATION, TRANSMISSION AND DISTRIBUTION" IN EU28

(2016, MILLIONS OF EURO)



Source: Elaboration on Eurostat data (Nace D351). Data not available for Cyprus, Luxemburg, Malta, Ireland

In 2016, the total number of companies in the sector, in Europe, was 100,000 (Fig. 3.3).

From 2011 to 2016 the number of companies has continued to increase with a positive trend (+ 44%).

Whilst "Trade in electricity" is the sub-sector that contributes most to the total turnover of the electricity sector, "Production of electricity" is the one that accounts for most in terms of number of companies (90% of the total company number of the sector).

If we look at the distribution of companies in Europe, (Fig.3.4) we see that, in 2016, France was by far the country with the highest share (29,000 companies) with a significant advantage over Spain which is second, followed by the Czech Republic.

According to Eurostat data, in 2016, nearly 94,000 people were employed in the electricity sector accounting for just 0.5% of total employment in EU28[10]. The most significant increase in employment was registered between 2013-2014 (+2.3%) and, although the overall trend in the five years considered (2011-2016) is positive (+2.7%), between 2015 and 2016 employment in the sector registered a slight decrease (Fig.3.5).

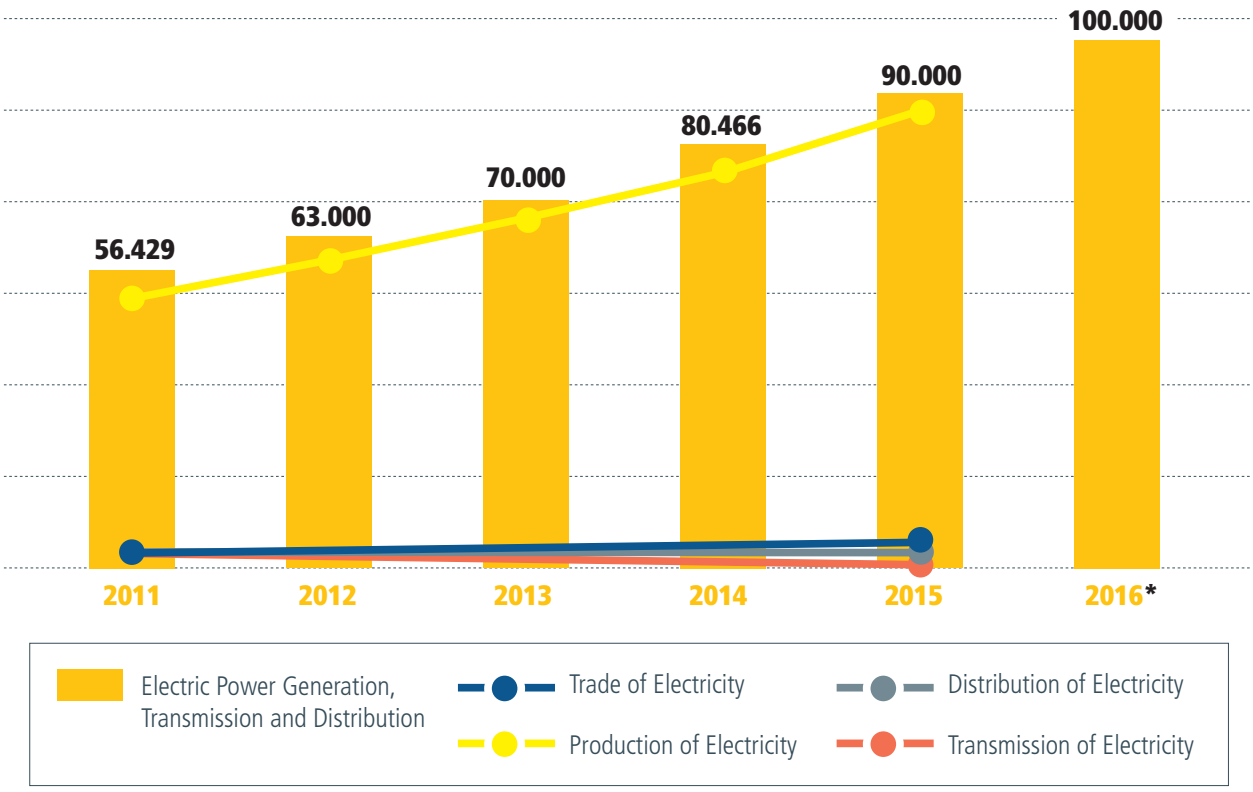
"Production of electricity" and "Distribution of electricity" are the sub-sectors that most contribute to the overall employment in the electricity sector. In 2015, the two sectors together accounted for 84% of total employment in the electricity sector.

[10] 2016 of the EU Labour force survey (LFS)

FIGURE 3.3

N° OF ENTERPRISES IN THE INDUSTRY "ELECTRIC POWER GENERATION, TRANSMISSION AND DISTRIBUTION" IN EU28

(N°)



Source: Elaboration on Eurostat data (Nace D351). Data not available for Italy (2016), Lichtenstein, Malta, Ireland.

In the five years considered, the sub-sector "Transmission of electricity" saw the most significant increase in the employment rate (+13%), followed by "Distribution" (+3.2%) and "Production of electricity" (+2.8%) while "Trade of electricity" is the only sub-sector that registered a decrease in people employed (- 7%) (Fig. 3.6).

The following figure shows the average dimension of companies in the electricity sector by country (Fig.3.7).

Germany is the country which has the largest dimension of companies with an average of 136 persons employed, followed by Norway and Romania.

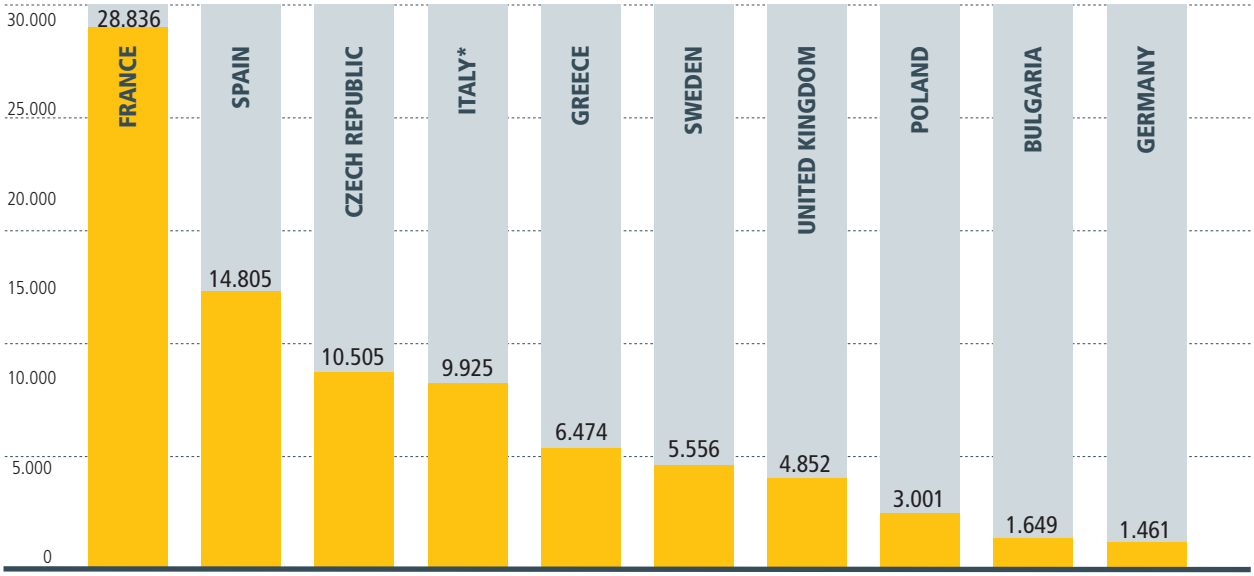
Figure 3.8 represents the 11 countries that account for more than 80% of the total sectoral workforce in 2015. Data on employment in the electricity sector has been elaborated at a country level in order to define the scope of the research more precisely.

More updated data is now available on the Eurostat Database but the scope of the research was based on 2015 data.

FIGURE 3.4

TOP-TEN COUNTRIES - N° OF ENTERPRISES IN THE INDUSTRY "ELECTRIC POWER GENERATION, TRANSMISSION AND DISTRIBUTION" IN EU28

(N°, 2016)

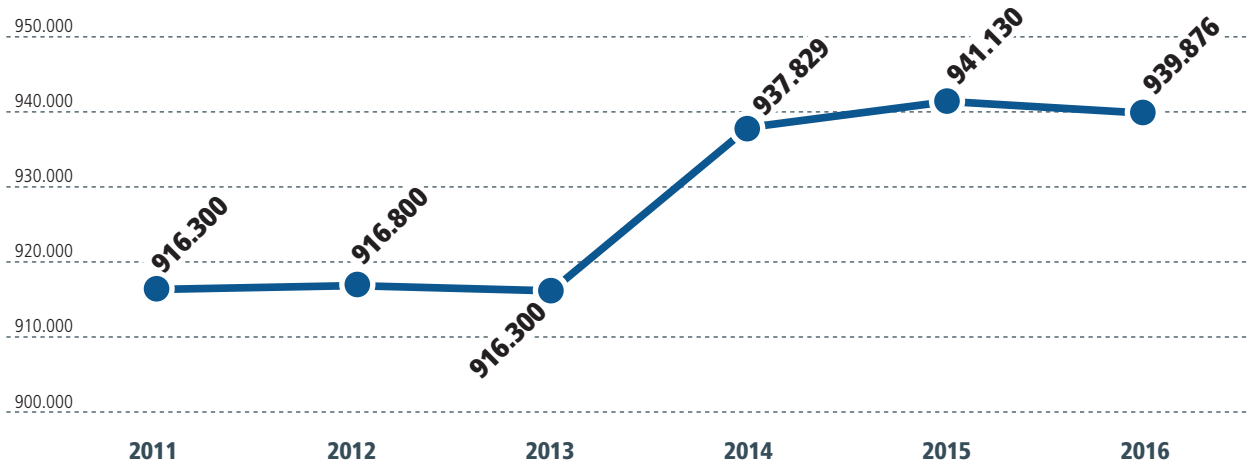


Source: Elaboration on Eurostat data (Nace D351). Data not available for Italy (2016), Lichtenstein, Malta, Ireland. * Data referred to 2015

FIGURE 3.5

N° OF PERSONS EMPLOYED IN THE SECTOR "ELECTRIC POWER GENERATION, TRANSMISSION AND DISTRIBUTION" IN EU28

(N°)

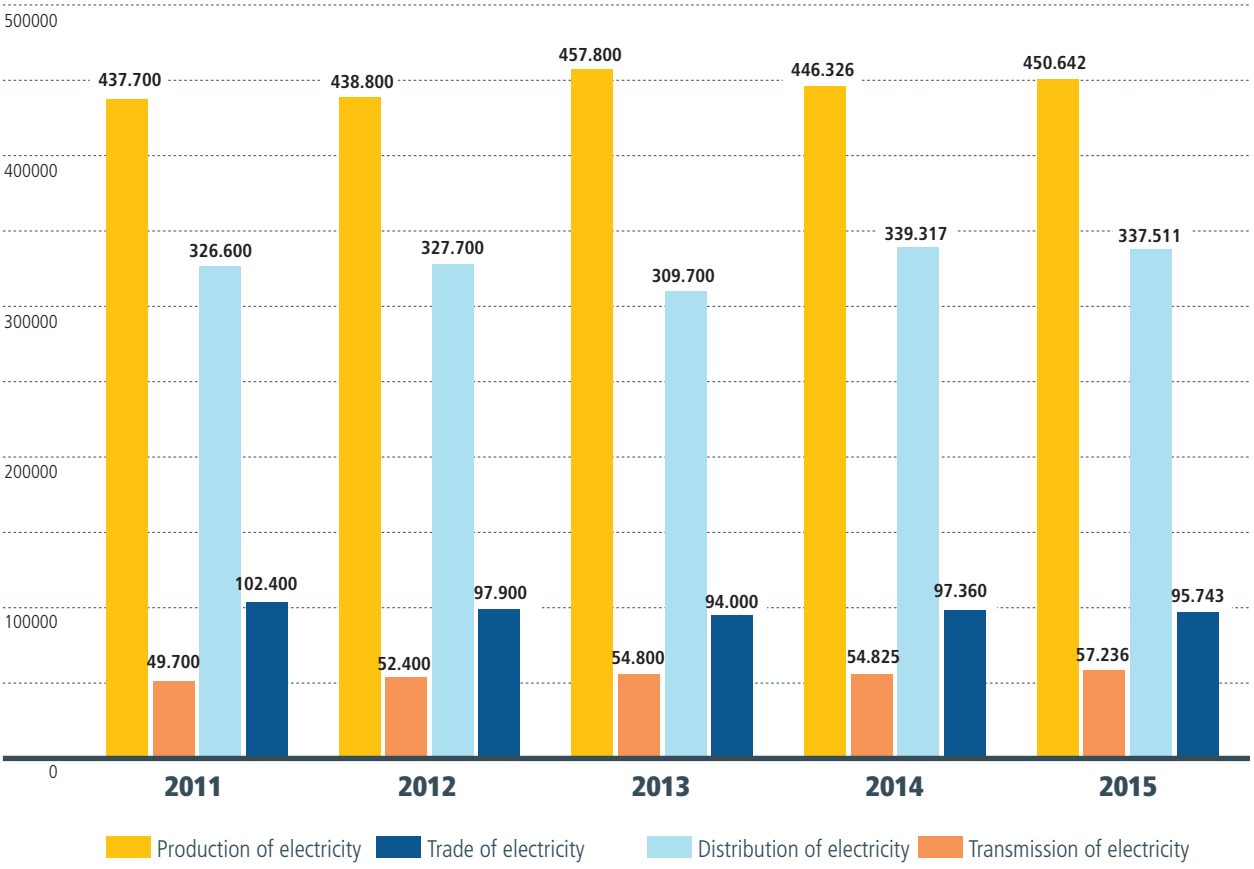


Source: Elaboration on Eurostat data (Nace D351), data na for France (2016), Netherlands, Malta, Ireland, Liechtenstein, Luxembourg.

FIGURE 3.6

N° OF PERSONS EMPLOYED BY SUB-SECTORS "ELECTRIC POWER GENERATION, TRANSMISSION, DISTRIBUTION AND TRADE" IN EU28

(N°)

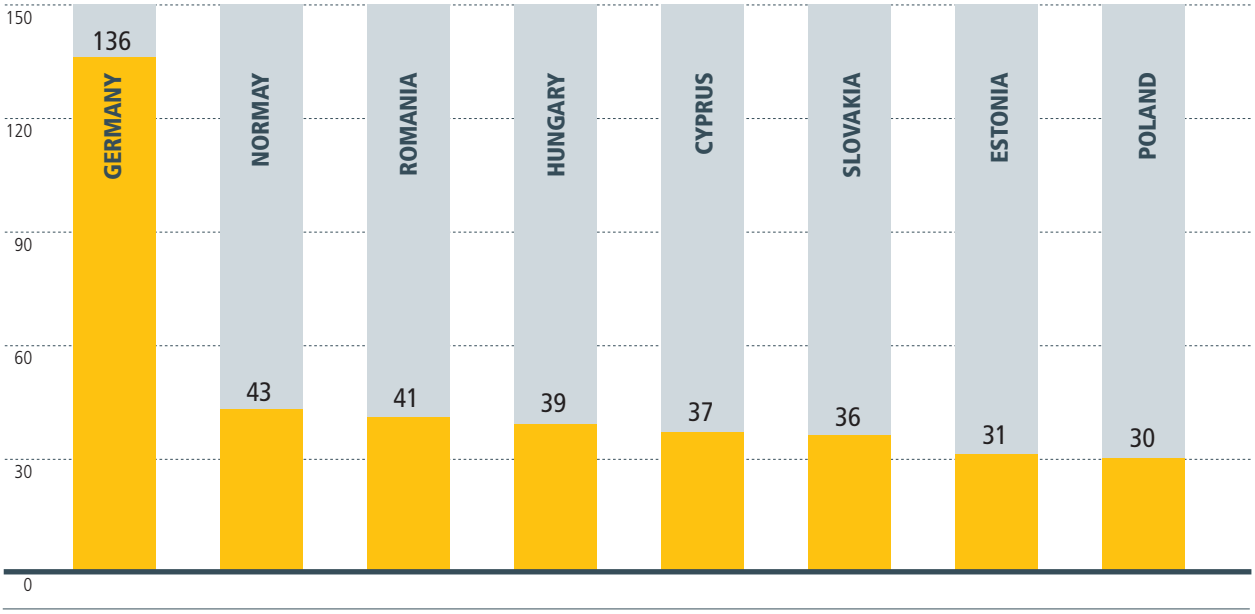


Source: Elaboration on Eurostat data (Nace D351.1. D351.2, D351.3, D351.4); 2016 data na for subsector; data na for Netherlands, Malta, Ireland, Liechtenstein, Luxembourg

FIGURE 3.7

N° OF PERSONS EMPLOYED PER ENTERPRISE IN THE INDUSTRY "ELECTRIC POWER GENERATION, DISTRIBUTION AND TRANSMISSION"

(N°, 2015)

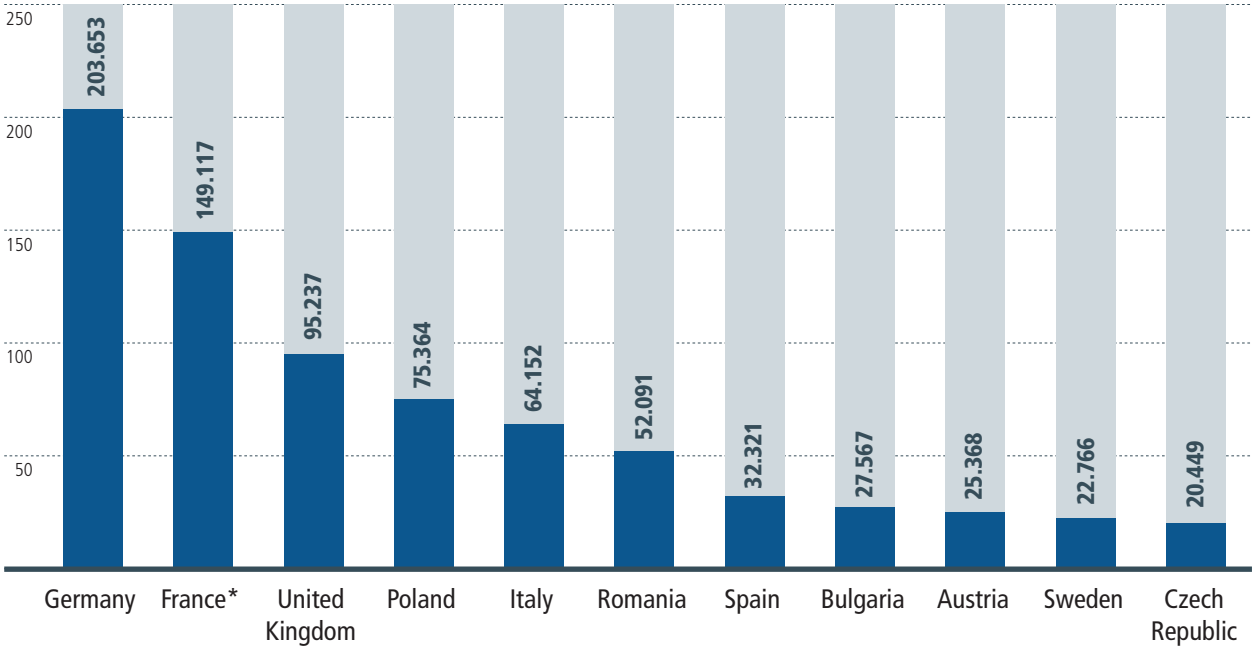


Source: Elaboration on Eurostat data (Nace D351). Data na from Netherlands, Ireland, Luxembourg, Malta.

FIGURE 3.8

COUNTRIES THAT ACCOUNT FOR 80% OF EMPLOYED PERSONS IN THE INDUSTRY "ELECTRIC POWER GENERATION, TRANSMISSION AND DISTRIBUTION"

(N°, 2015)



Source: Elaboration on Eurostat data (Nace D351). * Data referred to 2014 data, 2015 n.a

4. KEY FINDINGS: RECOMMENDATIONS

4. KEY FINDINGS: RECOMMENDATIONS

In order to meet this report's stated outcomes, and support the elaboration of a roadmap on education and skills in the changing electricity sector, a set of recommendations are provided, following a logical structure that summarizes short, clear and specific proposals to European social partners in the electricity sector.

Recommendations will also represent the framework for implementation of prioritized actions during the following years of activity. The following stakeholders have been identified as recipients of the recommendations:

- European Commission
- European social partners
- National social partners
- Local authorities
- Vocational-training providers

Each recommendation has been addressed to one main stakeholder and then to other actors, who are asked to provide specific supporting actions to aid their implementation. The overall objective is to provide the electricity sector, through the European social partners, with strategies and tools aimed at improving the qualifications of the sectoral labour force, and at assisting enterprises to be more flexible in meeting changing competitive demands.

The following recommendations include main outputs from national social partners from during the discussions at the mid-term conference.

LOGICAL STRUCTURE OF RECOMMENDATIONS

The set of five proposed recommendations and supporting actions is detailed in the following format:

- Main stakeholder: identification of the category of stakeholder that has the main role in implementing the recommendation
- Title and brief description of the recommendation
- Other stakeholders: other key actors to facilitate the implementation of the recommendation
- Supportive actions: actions proposed to the stakeholders to implement the recommendation

RECOMMENDATION 1

MAIN STAKEHOLDER ADDRESSED: NATIONAL SOCIAL PARTNERS

RECOMMENDATION 1: STRENGTHEN THE ROLE OF SOCIAL PARTNERS IN THE INTERACTION WITH VET PROVIDERS

One of the key lessons from the project study was the weakness of relationships between national social partners and VET providers. Regional seminars and survey results made clear the need to strengthen collaboration on updating curricula and educational programmes in the sector, in order to meet the skills needs of the industry. Social partners will need to gain sectoral intelligence on the skills needs over a timeframe of at least the next 10 years (see Recommendation n.2).

The diversity in European education systems makes it very complicated to suggest a common approach to achieve this aim. National social partners should therefore adapt their approach to national contexts and, where already in force, use social dialogue structures or should identify alternative stakeholders such as bipartite or tripartite organizations with VET providers and national social partners in the lead.

Interaction between VET providers and national social partners to build capacity should be sector-specific and continuous, based on sectoral intelligence on skill developments.

SUPPORTIVE ACTIONS FROM OTHER STAKEHOLDERS:

STAKEHOLDER	DESCRIPTION OF THE SUPPORTIVE ACTION
EUROPEAN COMMISSION	Favor the creation of sectoral social dialogue, facilitating the conditions including through specific financial support.
EUROPEAN SOCIAL PARTNERS	Facilitate national social dialogue meetings; to define the objectives of a common action plan and to present results of research as a starting point for discussions on skill developments.
NATIONAL SOCIAL PARTNERS	National social partners have a key role in the implementation and should organize the set of national meetings to facilitate the process.
LOCAL AUTHORITIES	Participate in national meetings and validate the activities.
VET PROVIDERS	Participate in national meetings and validate the activities.

RECOMMENDATION 2

MAIN STAKEHOLDER ADDRESSED: EU SOCIAL PARTNERS

RECOMMENDATION 2: MAINTAIN AND UPDATE SECTORAL INTELLIGENCE ON SKILLS NEEDS, IN ORDER TO PERIODICALLY REVISE STRATEGIES AND ACTIONS

Sectoral intelligence on skills needs from the industry is another key issue which is very much linked to the first recommendation: in order to orient VET provision, EU social partners would need to maintain, at EU level, sectoral intelligence on skills needs as required by the changing electricity market.

SUPPORTIVE ACTIONS FROM OTHER STAKEHOLDERS:

STAKEHOLDER	DESCRIPTION OF THE SUPPORTIVE ACTION
EUROPEAN COMMISSION	Facilitate the entire process including through specific financial support.
EUROPEAN SOCIAL PARTNERS	The EU social partners play a key role in this goal, and should maintain the general sectoral overview with updated intelligence on skills evolution and employment trends. There is a need for active transversal participation across Commission services and activities regarding the issue of skills. Intelligence should be used to better orientate policies and actions at an EU level and provide updated information to national social partners. Recognized existing European sources should be evaluated and taken as references, eg. Cedefop, Esco and Ecvet.
NATIONAL SOCIAL PARTNERS	National social partners should define an efficient system to collect and elaborate reliable data updates on skill development and skill gaps, interacting with other national stakeholders (in particular companies and VET providers). This information at national level should be provided to EU national partners in order to validate the strategies (link between national and EU level).

RECOMMENDATION 3

MAIN STAKEHOLDER ADDRESSED: EU SOCIAL PARTNERS

RECOMMENDATION 3: SYNTHESIZE BEST PRACTICES IDENTIFIED DURING THIS PROJECT AND DEFINE PRACTICAL APPROACHES AND CAPACITY BUILDING PROJECTS IN ORDER TO SPREAD THEM ACROSS EUROPE

EU social partners should use the best elements—those which have proven to be effective in best practices identified in the report and in other sectors—to implement projects at a national level when possible.

The best practices identified should focus mainly on: sectoral education schemes, mentorship programmes and life-long learning.

SUPPORTIVE ACTIONS FROM OTHER STAKEHOLDERS:

STAKEHOLDER	DESCRIPTION OF THE SUPPORTIVE ACTION
EUROPEAN COMMISSION	Facilitate the process including through specific financial support.
EUROPEAN SOCIAL PARTNERS	EU social partners have a key role in order to: - Provide national social partners with relevant information and details on best practice (for example through a Best Practice Guideline) - Facilitate the implementation of activities at a country level in order to achieve the objectives of the roadmap.
NATIONAL SOCIAL PARTNERS	National social partners should define an efficient system to collect and provide information on best practice, interacting with other national stakeholders (in particular companies and VET providers). National social partners should define approaches to implement roadmap activities at a country level.

RECOMMENDATION 4

MAIN STAKEHOLDER ADDRESSED: EU SOCIAL PARTNERS

RECOMMENDATION 4: DEVELOP A SECTOR SKILLS ALLIANCE AIMED AT IDENTIFYING AND IMPLEMENTING KEY SKILLS OBJECTIVES (AMONG OTHERS QUALIFICATION AND RECOGNITION SYSTEMS)

Recognition of skills and competences, within a European sector that is comprised of multiple countries and multiple systems, is crucial to deal with skills shortages in occupations arising from changes in the electricity sector. It also adds value to the education and training activities in companies.

This recommendation requires an industry-driven approach and could be implemented quite rapidly in order to create a model of excellence in sectoral education and training.

EU social partners should, therefore, stimulate debate on creating a common EU module for the different curricula in the sector. The means of achieving this aim are to be identified at a national level.

SUPPORTING ACTIONS FROM OTHER STAKEHOLDERS:

STAKEHOLDER	DESCRIPTION OF THE SUPPORTIVE ACTION
EUROPEAN COMMISSION	Facilitate the process including through specific financial support.
EUROPEAN SOCIAL PARTNERS	The European social partners have a key role in order to: - Agree on the set of competences with a unique taxonomy, making reference to existing European guidelines such as Europass, Esco, Ecvet - Identify representative job profiles, both specific and cross-sectoral - Identify the education and training paths and qualifications needed to acquire the skills
NATIONAL SOCIAL PARTNERS	Main activities for national social partners should be aimed at: - Defining strategies to build capacity with VET providers - Defining action plans and implementing the mutual recognition and certification system

RECOMMENDATION 5

MAIN STAKEHOLDER ADDRESSED: EU SOCIAL PARTNERS

RECOMMENDATION 5: DEFINE AND IMPLEMENT A SYSTEMATIC STRATEGY TO IMPROVE THE ATTRACTIVENESS OF THE SECTOR TO POTENTIAL EMPLOYEES

There should be a systematic approach in place to compete with other sectors to attract the best, skilled young workers given that other sectors have strategies already in place.

SUPPORTING ACTIONS FROM OTHER STAKEHOLDERS:

STAKEHOLDER	DESCRIPTION OF THE SUPPORTIVE ACTION
EUROPEAN COMMISSION	Support and promote the overall process including through financial support
EUROPEAN SOCIAL PARTNERS	EU Social Partners have a main role in order to: - provide content on long-term sectoral perspectives - establish common "attractive" education frameworks
NATIONAL SOCIAL PARTNERS	Active role in implementation; discuss and implement education frameworks in companies and promote the concepts among companies and employees

5. PART I
SKILLS EVOLUTION

5. PART I - SKILLS EVOLUTION

The research on skill developments, over at least the next 10 years, was a fundamental component of the overall study.

It investigated, firstly, the expected impacts of three drivers of change—decarbonization of the sector, structural and technological changes and new business models—it then reviews the expected effects on new needs in terms of skills and competences for 15 representative occupations.

The research was made through an online survey that targeted 184 stakeholders from leading European employers and trade-union federations in the electricity sector in 28 European countries.

The methodology and logical structure of the survey is described, in detail, in Annex 1 of the report.

In the following section, there is a brief description of each occupation, its classification and the main results from the survey as follows:

- Expected impacts of drivers of change

- Expected changes in skills needs

- New skills expected (as self-specified by respondents)

5.1 MAIN FINDINGS

OCCUPATION:

OPERATION & MAINTENANCE NETWORK ELECTRICIAN

CLASSIFICATION:

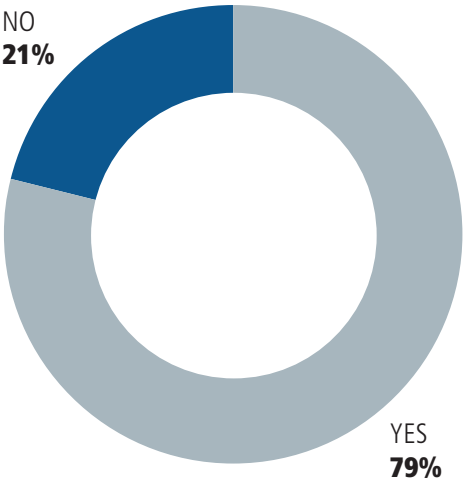
BLUE COLLAR / ISCO 08: #8 "Plant and Machine Operators and Assemblers"

DESCRIPTION:

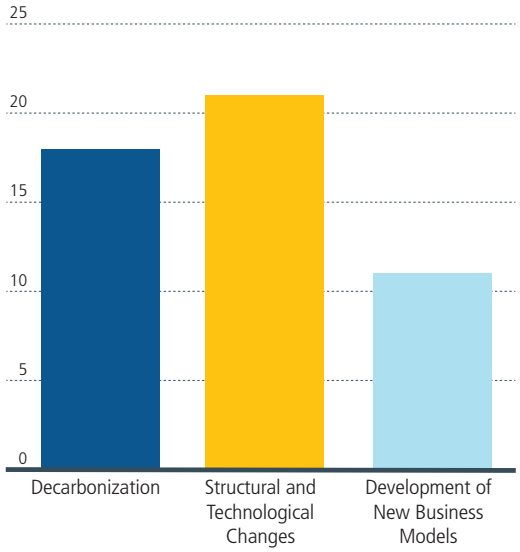
Skilled technician/mechanic that installs and maintains transport and distribution of electric energy especially from medium voltage to high voltage.

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT

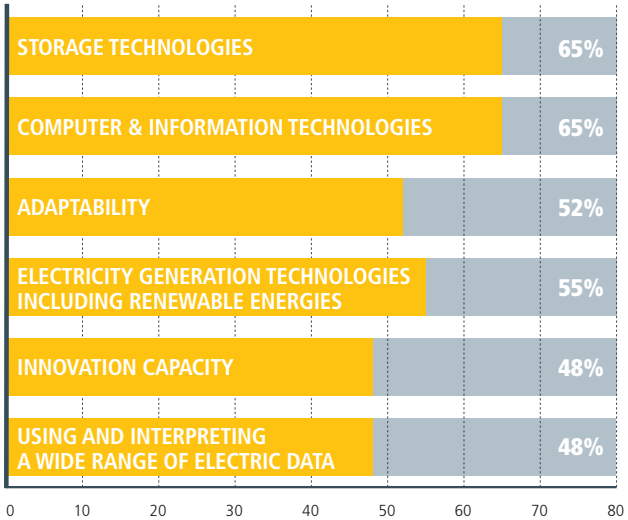


TRENDS



FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Customer Journey
2. Cyber Security
3. Fibre-Optic Maintenance
4. Internet of Things
5. Machine Learning & Artificial Intelligence

OCCUPATION:

OPERATION & MAINTENANCE: HOUSEHOLD METERING TECHNICIAN

CLASSIFICATION:

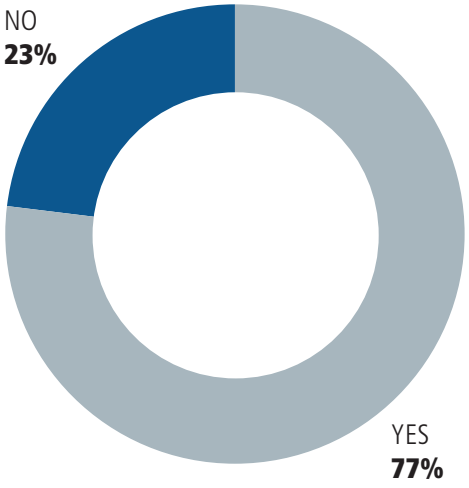
BLUE COLLAR / ISCO 08: #7 "Craft and Related Trades Workers"

DESCRIPTION:

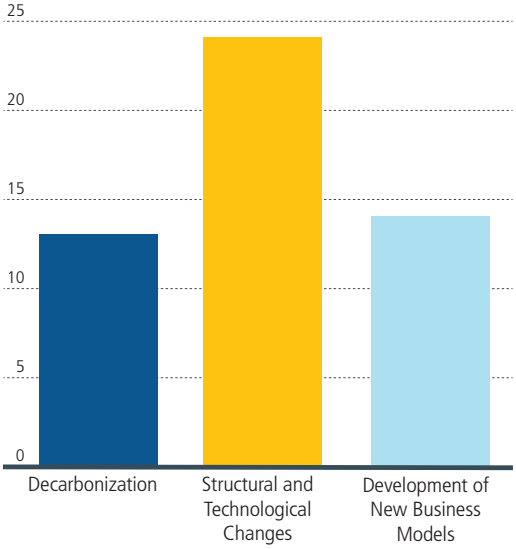
Technician who installs metering systems.

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT

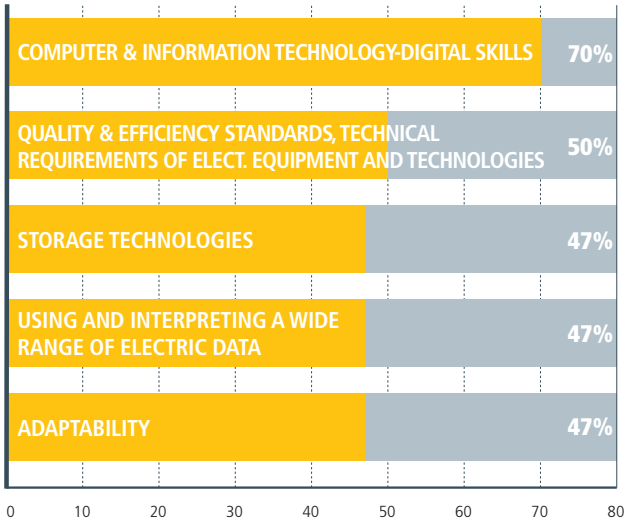


TRENDS



FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Automation and Controlling
2. Customer Journey
3. Cyber Security
4. Home automated and follow-up of consumption technologies
5. Internet of Things
6. Machine Learning and Artificial Intelligence
7. Telecoms skills associated with installation and maintenance of smart meters

OCCUPATION:

OPERATION & MAINTENANCE: FACILITY TECHNICIAN

CLASSIFICATION:

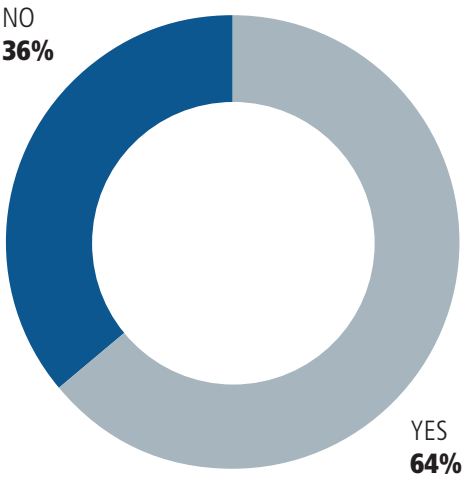
BLUE COLLAR / ISCO 08: #8 "Plant and Machine Operators and Assemblers"

DESCRIPTION:

Skilled technician that operates and maintains electricity-production facilities.

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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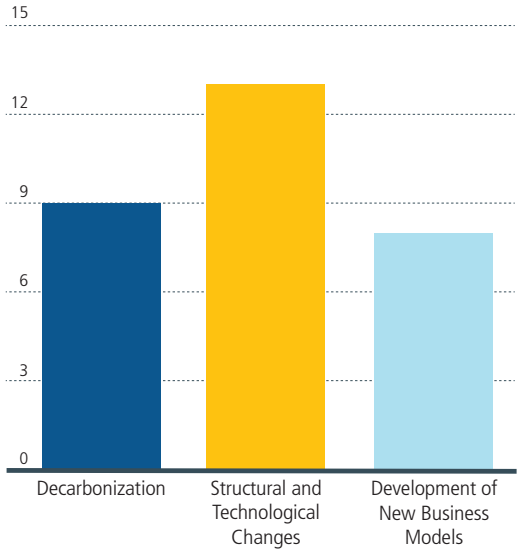
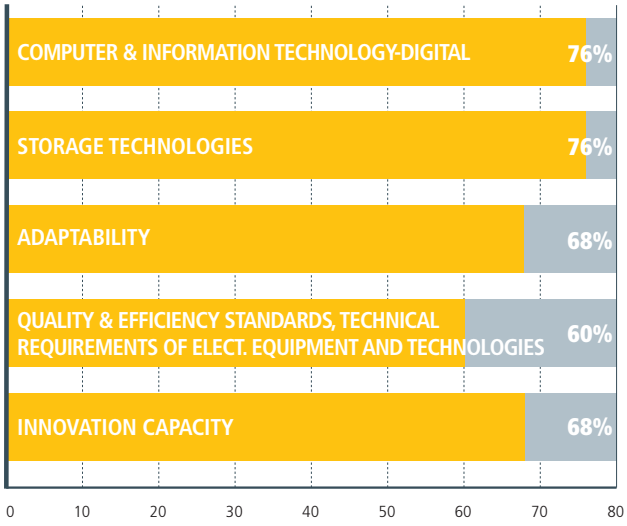


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Skills associated with installation and maintenance of large-scale new renewable and storage technologies
2. Skills required for operation and maintenance of carbon capture and storage facilities
3. Automation and controlling
4. Transformation manager
5. Drone piloting

OCCUPATION:

ENGINEER/TECHNICIAN: PLANNING & DEVELOPMENT

CLASSIFICATION:

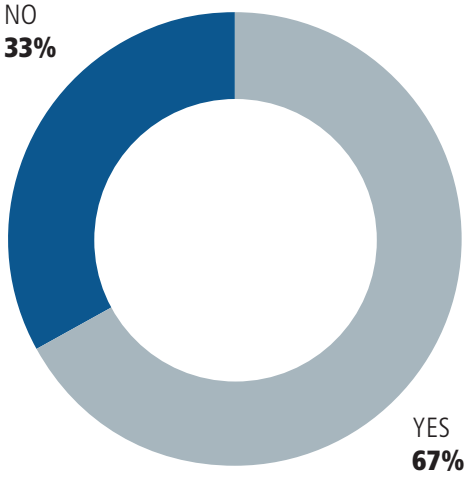
GREY COLLAR / ISCO 08: #3 "Technicians and Associate Professionals"

DESCRIPTION:

Engineer and/or senior technician that plans and develops, commissions and maintains electricity generation facilities.

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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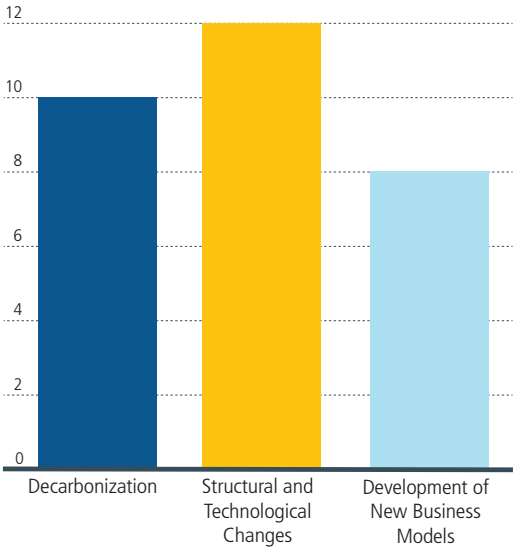
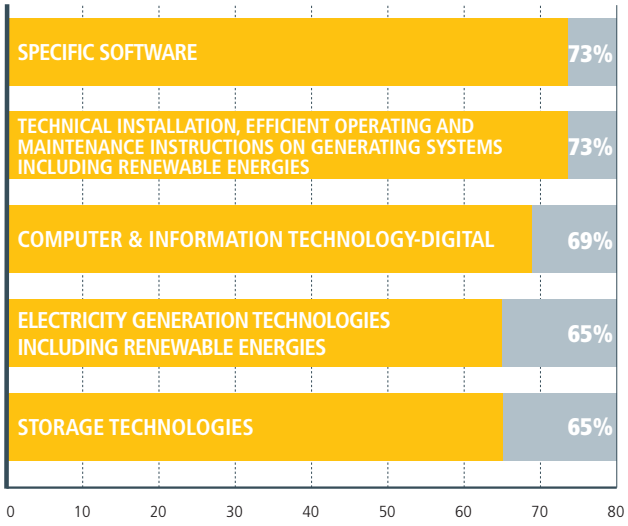


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Architecture skills for design of small facilities with a low impact on landscape

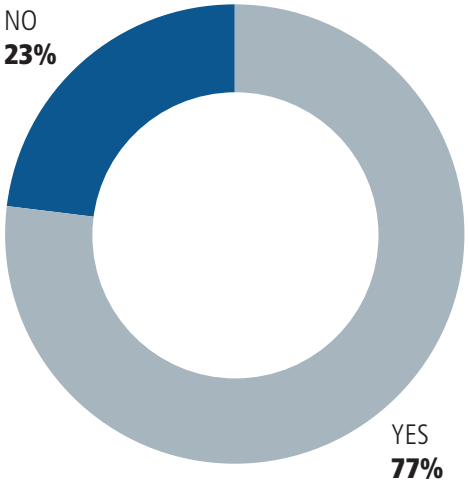
OCCUPATION:
ENGINEER - NETWORK

CLASSIFICATION:
GREY COLLAR / ISCO 08: #3 "Technicians and Associate Professionals"

DESCRIPTION:
Engineer that plans, constructs, installs and operates maintenance of transmission and distribution networks

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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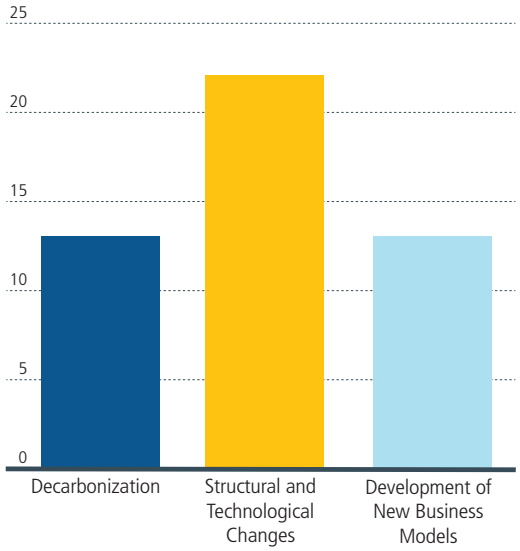
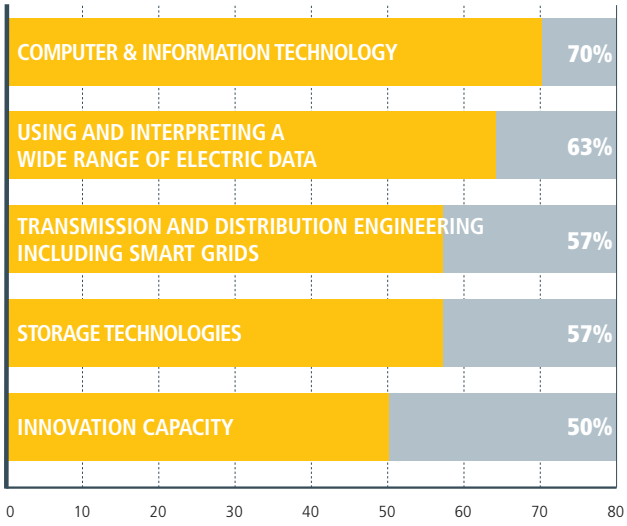


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Automation and Controlling
2. Customer Journey
3. Cyber Security
4. Internet of Things
5. Machine Learning & Artificial Intelligence
6. Fiber-Optic Maintenance

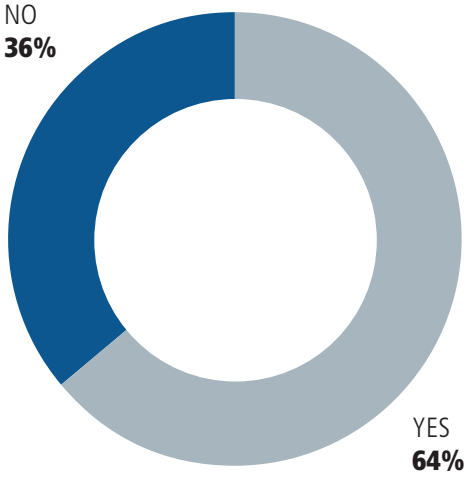
OCCUPATION:
ENGINEER: STORAGE

CLASSIFICATION:
GREY COLLAR / ISCO 08: #3 "Technicians and Associate Professionals"

DESCRIPTION:
All different kind of engineers and natural scientists for the development of energy storage

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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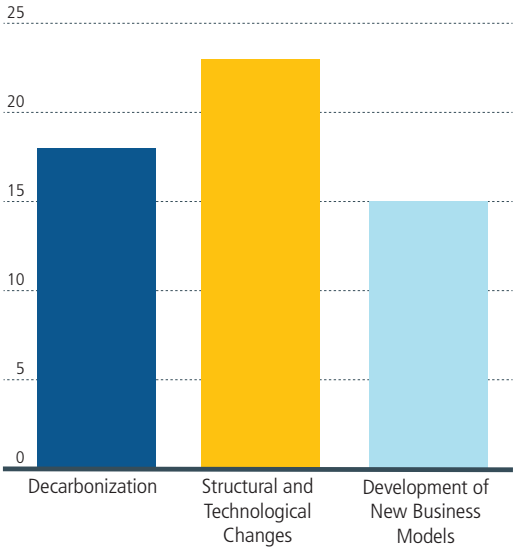
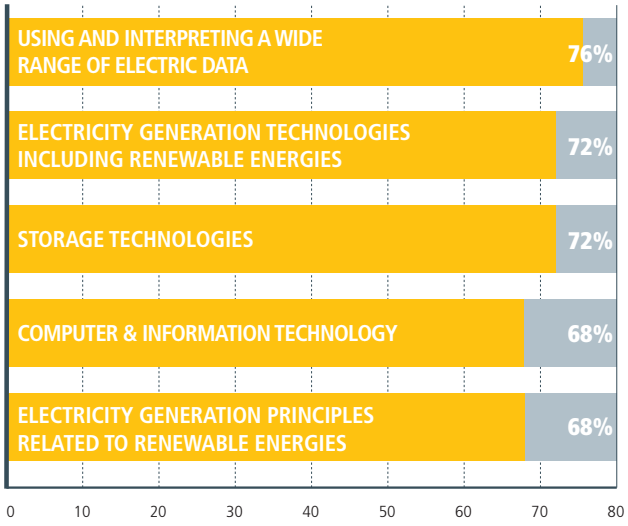


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Energy efficiency standards regarding different technologies

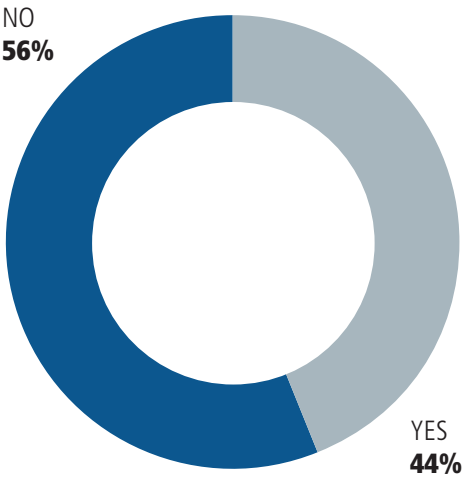
OCCUPATION:
ICT SPECIALIST: ICT TECHNICIANS

CLASSIFICATION:
GREY COLLAR / ISCO 08: #3 "Technicians and Associate Professionals"

DESCRIPTION:
Supports or facilitates the use of ICT equipment and applications by others

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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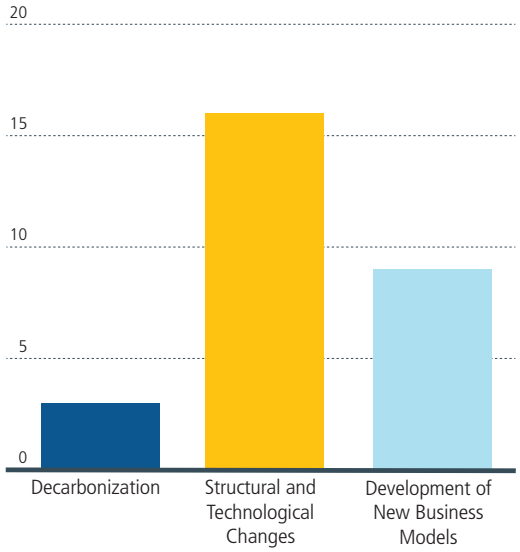
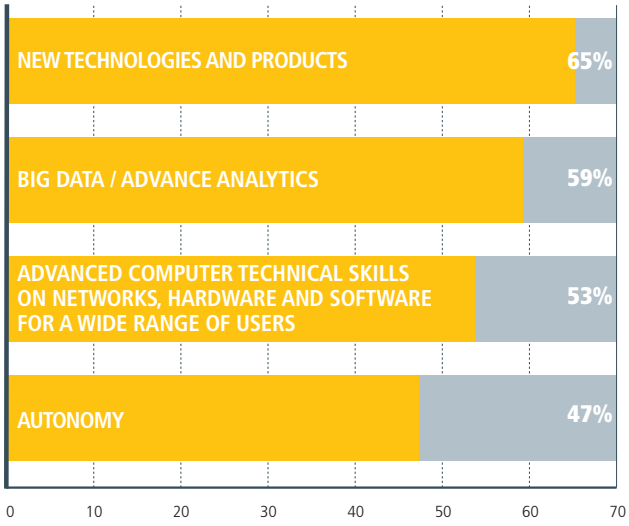


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Internet-of-Things Architect

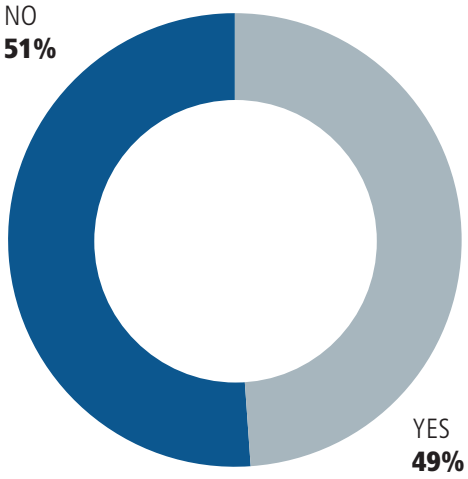
OCCUPATION:
ICT SPECIALIST: BIG DATA ANALYST

CLASSIFICATION:
GREY COLLAR / ISCO 08: #3 "Technicians and Associate Professionals"

DESCRIPTION:
Skilled ICT technician that knows how to manage and organize a wide range of information

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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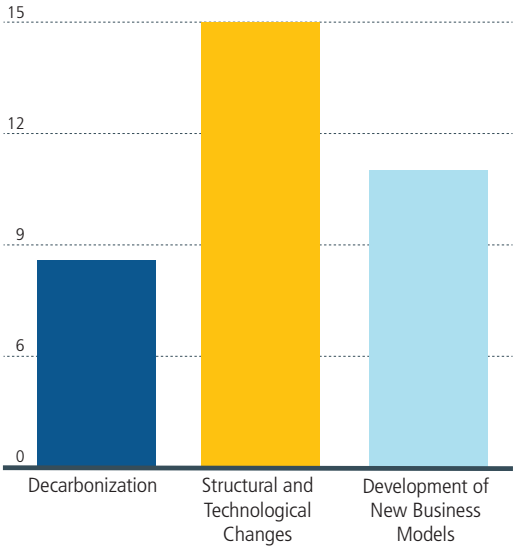
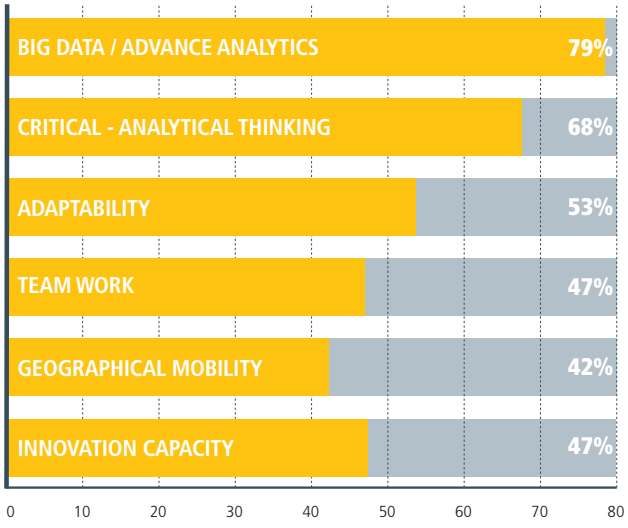


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Business Translator
2. Cyber Security
3. Data Owner
4. Scrum Master

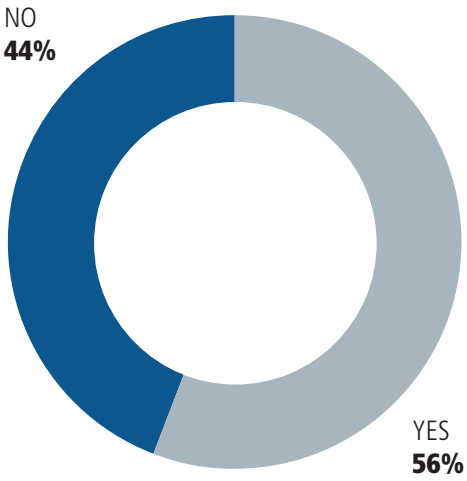
OCCUPATION:
NETWORK OPERATOR AND DISPATCHER

CLASSIFICATION:
GREY COLLAR / ISCO 08: #2 "Professionals"

DESCRIPTION:
High-skilled specialist that ensures the distribution and transmission of electricity through the network system and is located in a network-operation center.

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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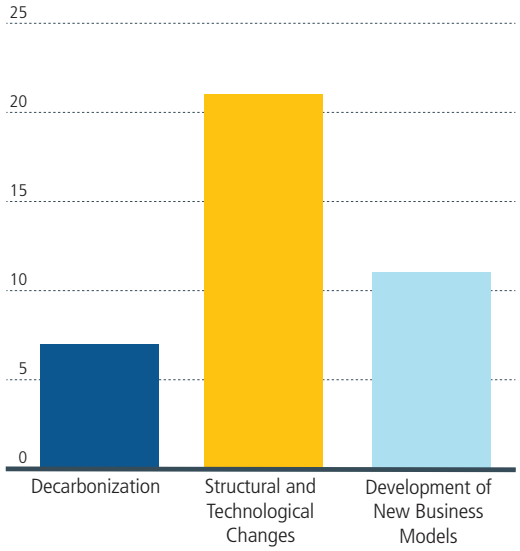
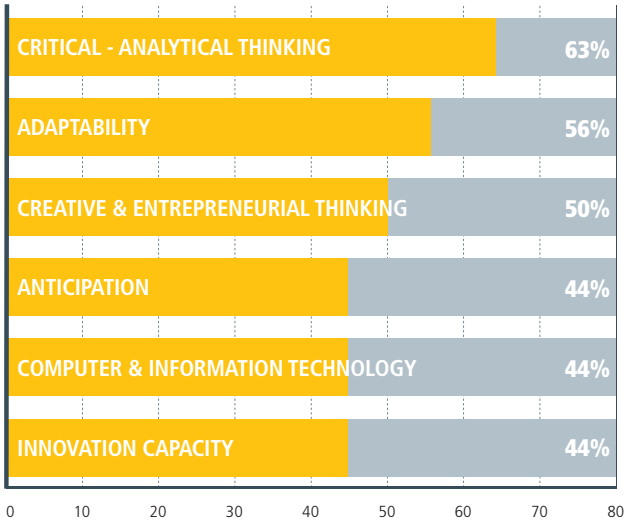


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Automation and Controlling
2. Big Data/Advance Analytics
3. Internet of Things
4. Machine Learning & Artificial Intelligence

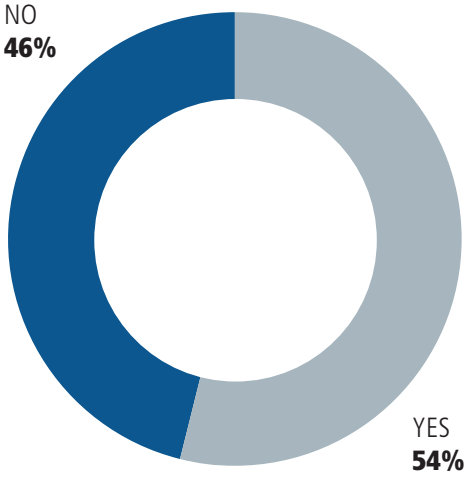
OCCUPATION:
PROJECT MANAGERS AND BUSINESS DEVELOPERS

CLASSIFICATION:
WHITE COLLAR / ISCO 08: #1 "Managers"

DESCRIPTION:
Project managers and business developers in the area of energy generation and distribution

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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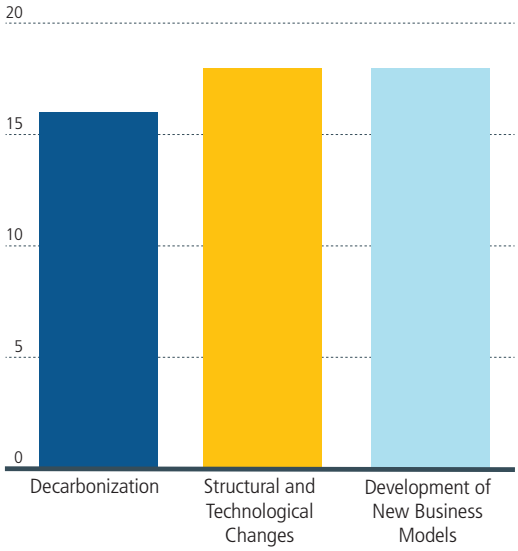
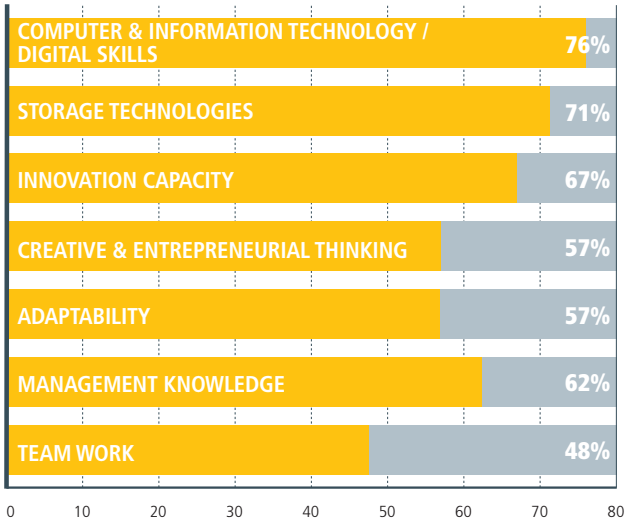


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Big Data/Advanced Analytics
2. Customer Journey
3. Cyber Security
4. Digital Mindset
5. Internet of Things
6. Machine Learning & Artificial Intelligence
7. Smart Grid
8. Communication Skills

OCCUPATION:

COMMERCE & TRADING: SALES MANAGER / OPERATIVES AND SALES EMPLOYEES

CLASSIFICATION:

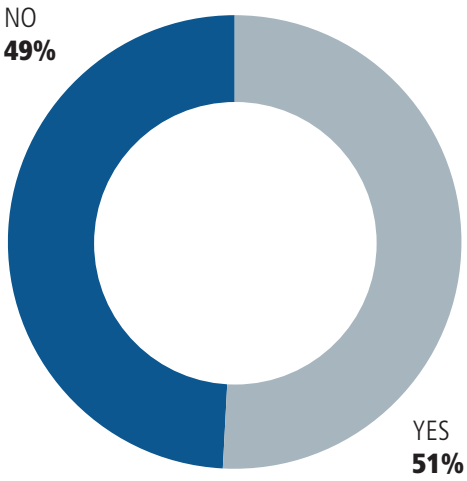
WHITE COLLAR / ISCO 08: #2 "Professionals"

DESCRIPTION:

Persons dealing with sales customers and businesses

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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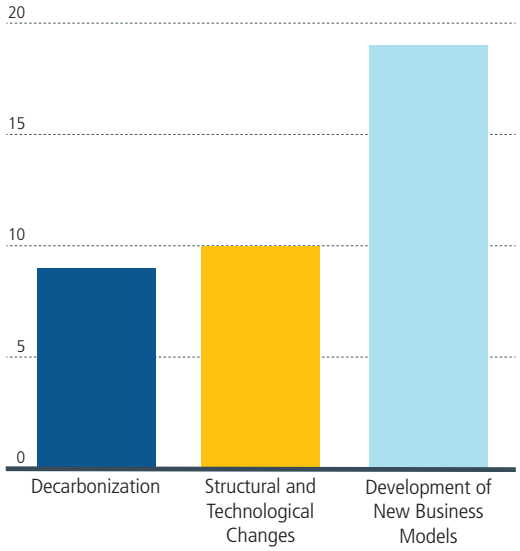
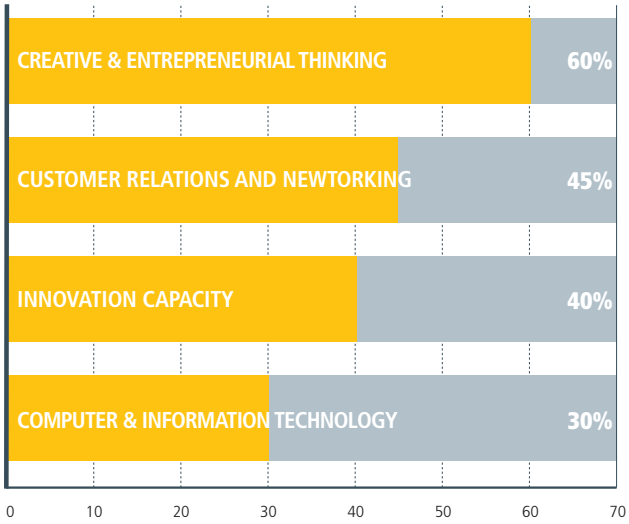


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Automation and Controlling
2. Digital Mindset
3. Social Selling

OCCUPATION:

COMMERCE & TRADING: CUSTOMER RELATIONSHIPS & SERVICES

CLASSIFICATION:

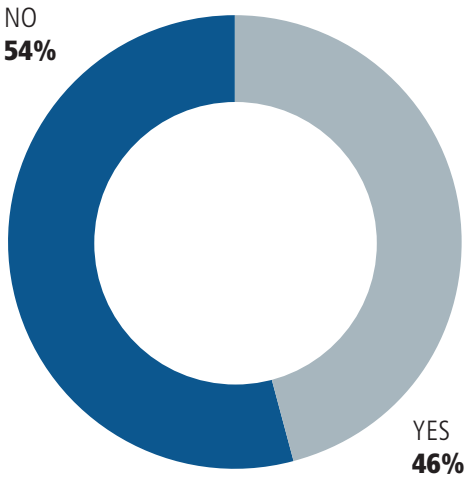
WHITE COLLAR / ISCO 08: #4 "Clerical support workers"

DESCRIPTION:

Persons dealing with customers (complaints, billing, services, outages, etc)

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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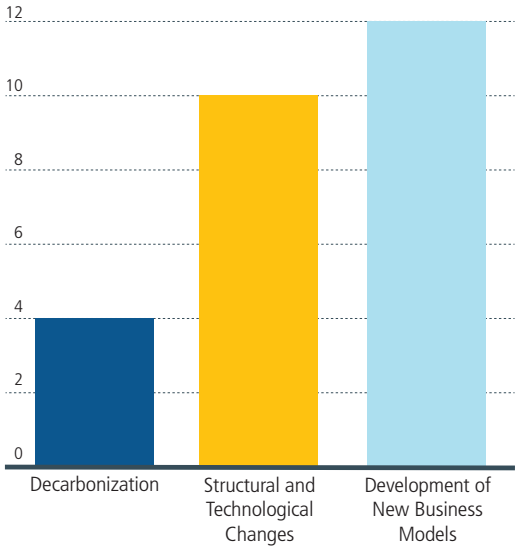
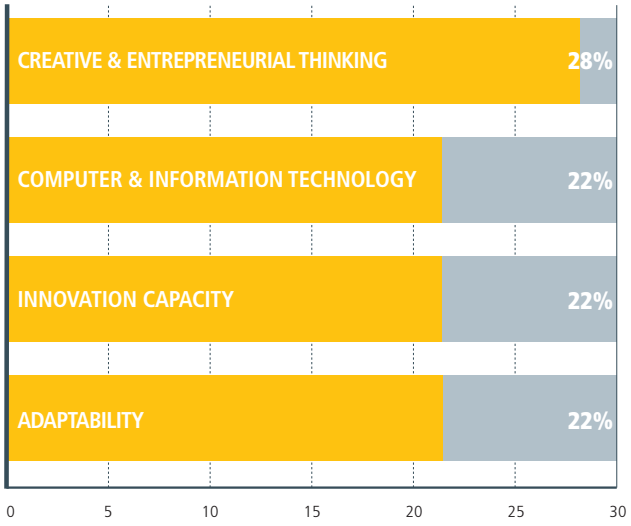


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Foreign languages- technical
2. Customer orientation/ Service orientation
3. Smart working & collaboration

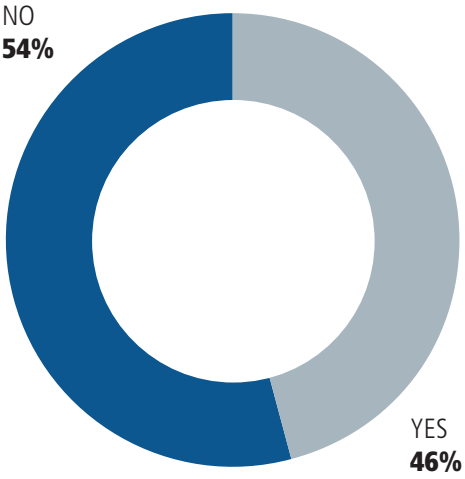
OCCUPATION:
ASSSET ENGINEER/MANAGER

CLASSIFICATION:
WHITE COLLAR / ISCO 08: #2 "Professionals"

DESCRIPTION:
Specialists responsible for different kind of assets (production & network)

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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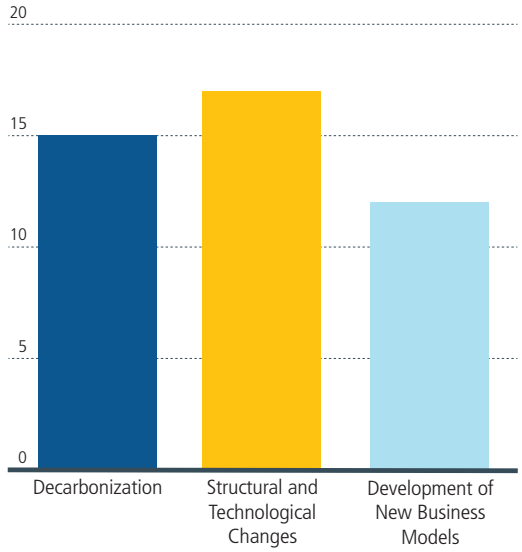
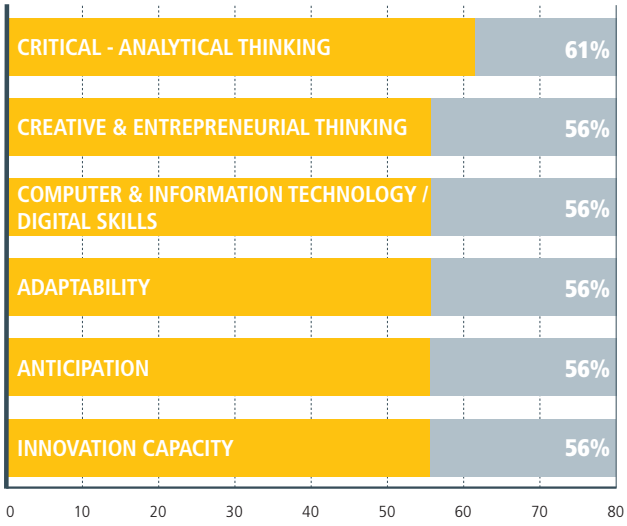


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



NEW SKILLS

1. Big Data/Advanced Analytics
2. Customer Journey
3. Fiber Optic Maintenance
4. Innovation Capacity
5. Smart Grid

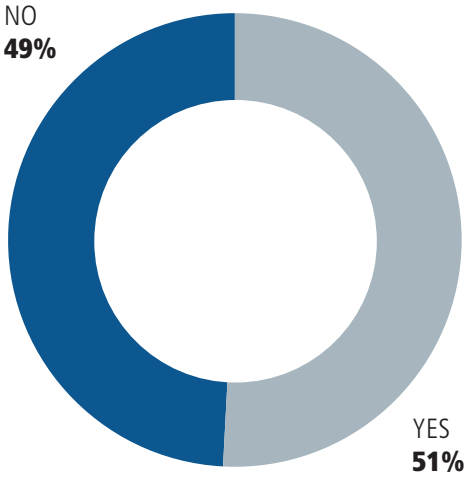
OCCUPATION:
ENERGY EFFICIENCY ADVISOR

CLASSIFICATION:
WHITE COLLAR / ISCO 08: #2 "Professionals"

DESCRIPTION:
Technicians/engineers consulting for clients regarding effective use of energy systems (domestic or industrial)

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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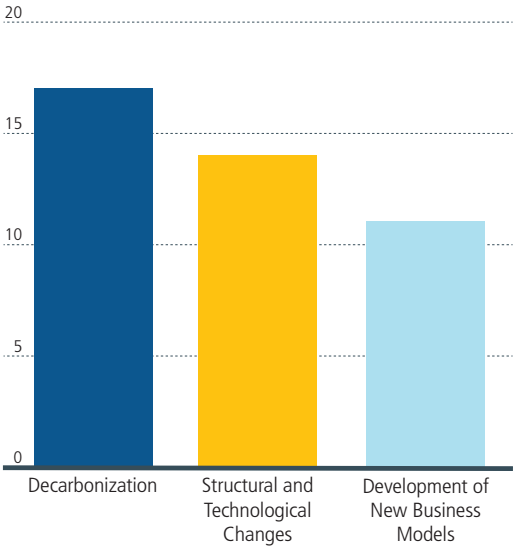
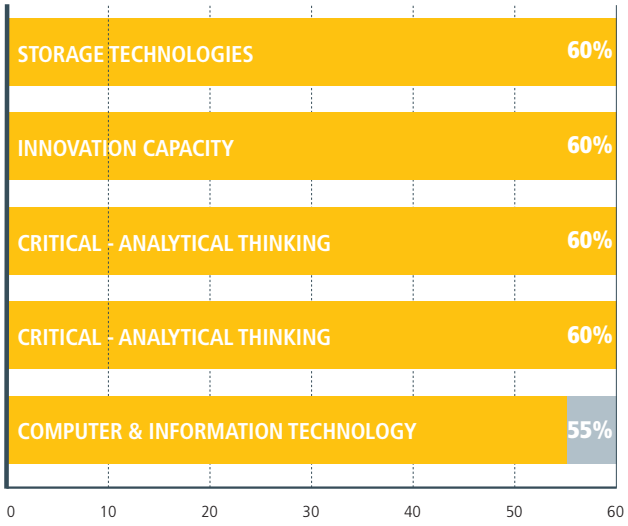


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



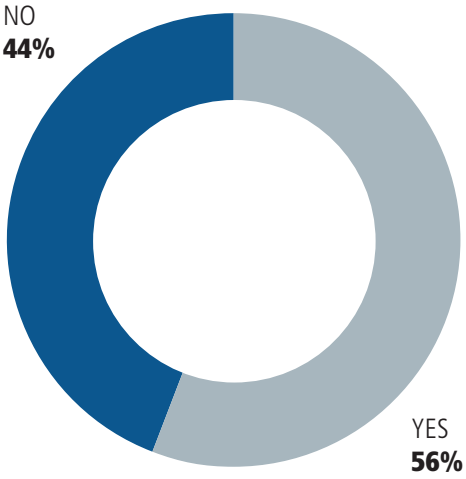
OCCUPATION:
BACK-OFFICE EMPLOYEE

CLASSIFICATION:
WHITE COLLAR / ISCO 08: #4 "Clerical Support Workers"

DESCRIPTION:
Supports companies in administration activity and supports personnel who are not client-facing

DRIVERS OF CHANGE - EXPECTED IMPACT ON OCCUPATION

IMPACT



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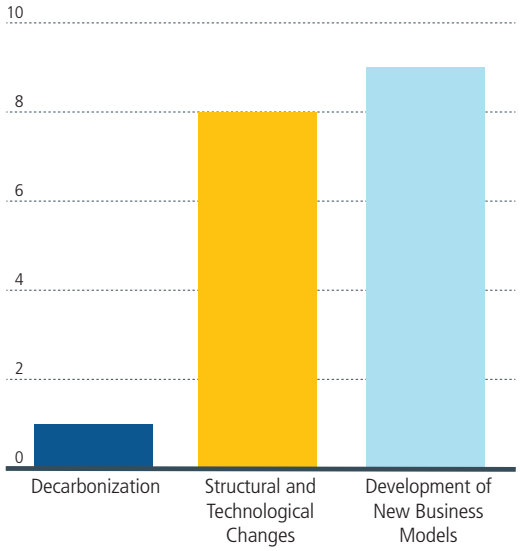
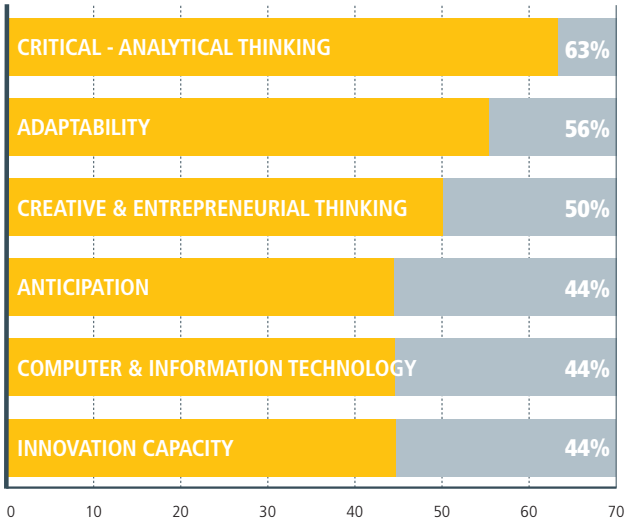


FORECAST ON SKILLS NEEDS – EXPECTED IN THE NEXT 10 YEARS

NEED TO UPDATE / DEVELOP MORE



5.2 IMPACT OF DRIVERS OF CHANGES ON OCCUPATIONS

Overall, our respondents expect that the most relevant driver with an impact on skills in occupations will be "technological and structural changes" over and above "decarbonization" and "new business models".

Following "structural and technological changes", the second drivers, in terms of expected impact, are "decarbonization", for blue-collar categories, and "new business models", for white-collar workers.

What seems certain is that occupations in the sector will need to incorporate new skills due to the impact of these drivers: more than 50% of respondents replied affirmatively that these would impact on 10 out of the 15 occupations considered.

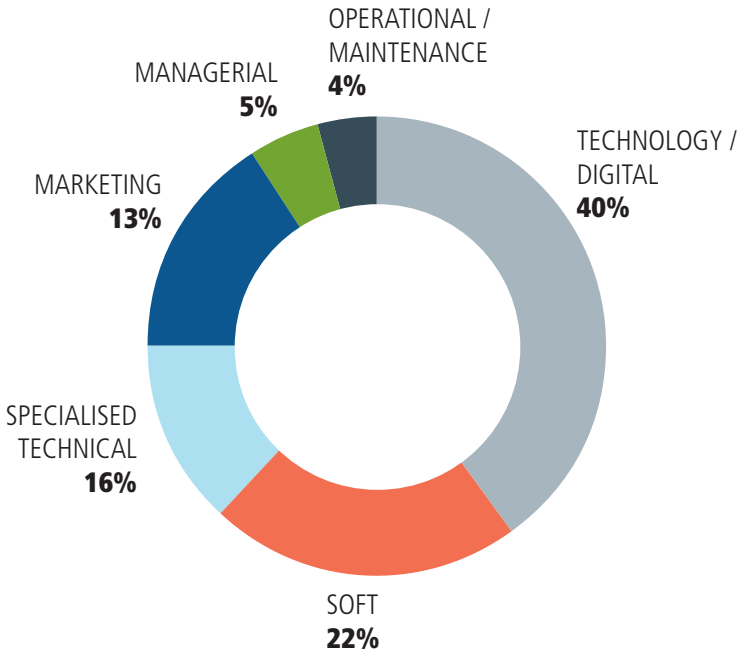
However, this aggregated-view masks important differences amongst the categories: respondents expect strong impacts on the blue-collar occupations (74% of replies), which relate to operational and maintenance occupations such as installation, retrofitting, repairing and maintenance of networks, meters and facilities; following blue collar, the second category that is expected to be most impacted is grey collar, which corresponds to Engineering and ICT Technicians. In contrast, with white-collar jobs, which correspond to managers, professionals and office occupations, impact expectations are below 50%. However, this still represents a high degree of change.

5.3 EVOLUTION OF SKILLS IN OCCUPATIONS

Overall, the skills needs forecast for each occupation resulted in 45 specific skills which cut across occupations, belonging to the following categories (Fig.5.1).

FIGURE 5.1

FORECAST IN SKILLS NEEDS IN NEXT 10 YEARS
CATEGORY DISTRIBUTION



- n. 7 Specialized Technical skills
- n. 2 Managerial skills
- n. 2 Operation and maintenance skills
- n. 6 Marketing skills
- n.18 Technology / Digital skills:
- n. 10 Soft skills

BLUE COLLAR: INSTALLATION AND MAINTENANCE OCCUPATIONS

Installation and maintenance technicians with more specialized technical skills—mainly associated with *storage technologies*—will be needed.

The new generation of installation and maintenance occupations are also expected to require more soft skills, mainly associated with interpersonal and social competences, such as *adaptability* and *innovation capacities. Customer skills* will also become increasingly important, enabling workers to adapt to different situations and clients in the framework of an energy transition away from a few big facilities, towards more small energy communities.

The new skillset needs for this category of occupations refer to technology/ digital skills such as *drone piloting*, that will be used for maintenance activity, as well as *machine learning & artificial intelligence*, *cyber security* and *Internet of Things.*

GREY COLLAR: ENGINEERS, ICT SPECIALIST AND NETWORK OPERATORS AND DISPATCHERS

The expected skill developments in engineering occupations are mainly related to advances in specialized technical skills associated with technological developments driving the global energy transition: increased knowledge on *storage technologies* and *smart grid implementation.* These will help ensure that integrated *renewable energy technologies* can hook up to the grid with sufficient transmission access.

According to respondents, digitalization also poses significant challenges in terms of the new skills required in engineering occupations. These include *using big data* from the grid and metering to build solutions and ensuring that this data is being correctly processed and handled. Advanced competence in *software and communications technologies* will also be key in this category. Soft skills, however, do not appear to be so relevant in this area.

ICT Specialist occupations, that include both Big Data Analyst and ICT Technicians, are expected to increase the demand for technological/digital skills associated *with specific software and hardware*, such as mobile internet and cloud technology, on top of *Business Translator* and *Scrum Master* software and dealing with a wide range of users. In this category, specific soft skills relate to changes in working style, such as *adaptability* and *team work*.

New skills for ICT Specialist- Big Data are mainly associated with digital skills such as *cybersecurity and data ownership.* These will be critical competences to mitigate the risks of cyber-attack and manipulation of energy tariffs/electric data and to deliver solutions that safeguard privacy and security.

For ICT Technicians, *Internet of Things* is a new skill expected to be in greater demand on the labour market to build end-to-end solutions and solve business problems.

Expectations on skill developments for Network Operators and Dispatchers, highly skilled specialists that ensure the distribution and transmission of electricity through network systems, relate mainly to digital and technology skills, from *computer operating systems* and network-system integration, to *big data analytics* to control network capacity and detect evidence of operating problems. For this occupation, soft skills such as *logic, critical and anticipating competences*, required to identify the strengths and weaknesses of alternative solutions or approaches to problems, are expected to be relevant to the sector in the future.

WHITE COLLAR: PROJECT MANAGERS, TRADE WORKERS AND BACK-OFFICE EMPLOYEES

According to respondents, the expectation for greater soft skills will be higher for white-collar occupations than for the other two categories. White-collar workers will have to demonstrate a variety of personal competences to deal with future changes in the electricity sector.

Creative & entrepreneurial thinking and *Innovation capacity* are expected to be the two key soft skills for project managers and business developers. For these occupations, such skills could become crucial in a highly-competitive future utility market characterized by new business models. Project managers are also expected to develop new competences and skills associated with the *digitalization* of the energy-business system, be able to use the amount and granularity of available data to gain competitive advantage, and develop innovative customer-oriented services besides just electricity supply.

As for project managers, skill developments for cross-cutting occupations, Commerce & Trade, Asset Engineer and Back-office occupations, are expected to require more soft skills such as *Creative & entrepreneurial thinking* and *Innovation capacity* as well as *Customer-orientation* skills.

Moreover, technological/ digital skills in *computer and information* and *advanced data analytics* are expected to be in higher demand, together with new specialized technical knowledge on issues associated with property asset management.

Energy-efficiency advisors will need more specialized technical knowledge on evolving *storage technologies* and the ability to *use and interpret a wide set of electric data* flow from more integrated renewable-energy generation systems.

5.4 MAIN OUTPUTS FROM REGIONAL SEMINARS

Before setting out the main conclusions from regional seminars, a clarification needs to be made in regard to the timeframe of meetings: although the seminars' aim was to stimulate discussion and collect information on research objectives, the early stage of research activities at the time of the first seminar in Central and Eastern European Countries didn't allow for discussions on survey results but instead focused on the peculiarities of national electricity systems, VET systems and VET best practices.

Main conclusions from the first Prague seminar with national social partners from Central and Eastern European Countries were as follows:

- Electricity systems vary significantly in participants' countries due to different national policies and regulations, economies, cultural and historical contexts and natural resource availabilities. In some countries, such as Romania, the electrification process and conventional meter roll-out is still underway, therefore impacts of the three drivers of changes are not yet relevant; the scoping for understanding future skills needs was therefore a difficult task.

- The energy supply sector typically represents the highest share of national employment in the Central and Eastern European Countries. There are, however, current shortages in the offer of engineering occupations and qualified workers; improving workers' qualifications and training is therefore a priority for the sector.

- The evolution of technologies and related skills needed in occupations were identified as a critical issue for the qualification of the workforce in the sector; training providers have a gap period of one or two years before catching up with technological developments in the market.

Main conclusions from the second regional seminar that took place in Madrid, with national social partners from Southern Europe were as follows:

- National social partners agreed with the overall picture presented from survey, with some differences in expectations (as briefly explained in the following points)

- General-trend forecasts for occupational categories: as an overall consideration, even though it falls outside the scope of the research objectives, national social partners have highlighted the trend towards the replacement of installation and maintenance occupations by machine and technological/digital developments in the sector. Smart meters will replace energy efficiency advisors, providing real-time consumption data. In general, the overall expected skills demand and employment trends follow the transition from blue-collar to grey and white-collar occupations.

- There was a general consensus on including *cybersecurity* skills and knowledge in the new set of future skills in ICT occupations. The digitalized power system is more exposed to hacking risks and this is a priority.

- There was general agreement with the survey results that technicians will need to be multi-technically skilled with an adequate set of soft skills. Soft skills are expected to become the competitive advantage for technicians in the sector as machines and information technology cannot replace or reproduce these. Facility Technicians will need more social and relational skills to facilitate direct relationships with customers in a decentralized-generation system where end-consumers also own a small generation facility which is connected to the grid. Technicians will need to develop new digital and technological skills associated with *en-*

ergy storage and (smart) grid developments whilst also being able to design micro-generation facilities.

- National partners didn't agree with survey replies that expect low impacts of Drivers of changes on ICT Specialists, Asset Managers and Commerce and Trading; according to their expectations these occupations will instead be significantly impacted by changes undergone by the sector due to shifting business models, more customer orientation and ICT developments. Moreover, financial skills and competences are missing in the forecasting of skills needs mainly for occupations such as Asset Managers and Project Managers.

- The attractiveness of the sector as an employer was another crucial issue raised and participants believed that a more in-depth understanding was needed of this this related to future-workforce skills: what do young people think about occupations and profiles offered by the sector? Is the sector attractive to a young student? This is a key issue that should be further researched.

The main conclusions from the third regional seminar that took place in Stockholm, with national social partners from North and Central Europe were as follows:

- In blue-collar occupations, national partners expect that the most important driver that will impact occupations is "new business models" and not "structural and technological developments", as indicated by the survey results. They agree on the increased importance of soft skills for this category and furthermore, expect a transition of these operational occupations to grey-collar categories; for example, O&M Household metering technicians will be replaced by occupations with skills associated with IT and digitalization, customer-oriented roles and with IT occupations that work in data security.

- For grey-collar occupations, national partners agree that they will all be impacted by the three drivers but mainly by the "decarbonization of the sector". Engineering categories are expected to gain more, highly-skilled qualifications, but in quantitative terms the labour-market demand will decrease: the number of workers needed to operate a thermal-power plant is higher than, for example, a wind-power plant. The labour market also expects grey-collar workers to acquire more technological and digital skills.

- White-collar occupations are expected to be mainly impacted by the driver of change "new business models". National social partners agree with the overall picture presented by the results of the survey on skill developments in occupations and no differences or national peculiarities were identified by participants.

- Overall there was general agreement on the priority of addressing skills mismatches with labour-market demand and the problem of skill shortage due to demographic trends and an ageing population.

6. PART II
VET PROVISION FOR THE ELECTRICITY SECTOR

6. PART II: VET PROVISION FOR THE ELECTRICITY SECTOR

6.1 GENERAL DESCRIPTION OF VET SYSTEMS

As described previously, the electricity industry employs people in a wide variety of occupations which carry their own requirements regarding vocational education and training.

VET in Europe is organized according to different systems and with a variety of key stakeholders.

VET SYSTEMS IN EUROPE

First of all… what does "VET" mean?

Vocational education and training (VET) means education and training which aims to equip people with the knowledge, know-how, skills and/or competences required in particular occupations or more broadly in the labour market.

Who are the VET providers?

In Europe, there is a rich diversity of national systems and stakeholders.

The VET services are provided by:

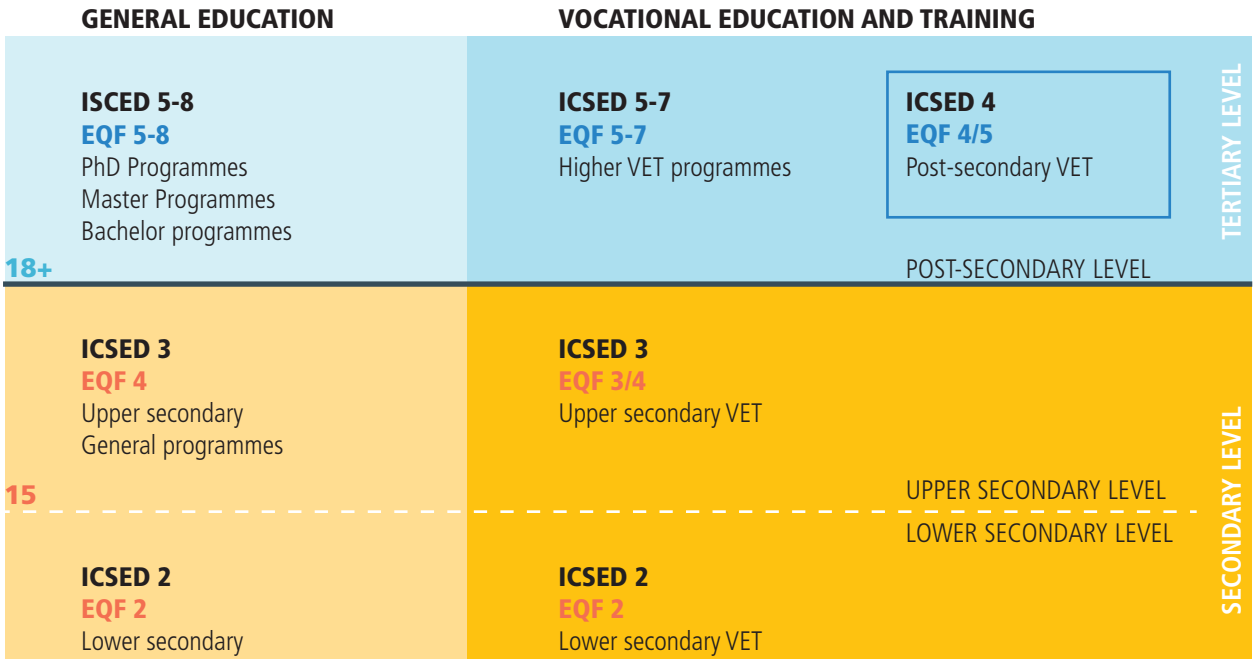
- Any organization specifically set up for this purpose (colleges, technical schools and institutes, universities of applied sciences);
- Employers, who provide training as a part of their business activities;
- Training providers which also include self-employed individuals who offer services.

Vocational education and training are offered at different levels of education (FIG.6.1):

- Secondary education, and mostly in upper-secondary education (ISCED 3);
- Post-secondary education (ISCED 4);
- Tertiary-education level (ISCED 5-7).

FIGURE 6.1

CLASSIFICATION ACCORDING ICSED



Vocational education can be offered in full-time schools or within the framework of the dual system, which means that training is conducted in two places of learning: companies and vocational schools. This system is practiced in several countries, notably Germany, Austria, and Switzerland but also now in Spain.

APPRENTICESHIPS, A PARTICULAR SYSTEM RECOGNIZED AS EFFICIENT IN COMBATING YOUTH UNEMPLOYMENT

An apprenticeship is a recognized and successful form of work-based learning that eases the transition from education and training to work and contributes to lower levels of youth unemployment. In fact, there is strong evidence that this system helps equip young people with valuable skills, particularly workplace skills, that ensure a greater degree of future employability.

Apprenticeships combine and alternate company-based training with school-based education and lead to a nationally recognized qualification upon successful completion. Most often there is a contractual relationship between the employer and the apprentice, and the apprentice is paid for his/her work.

There is evidence of significant net benefits for companies, primarily through lower recruitment costs but also through positive effects on the skills of supervisors and other staff. It is a win-win scheme for all: the company, the learner and society as a whole.

GOVERNANCE IN THE VET SYSTEM

Multilevel governance is a key instrument to ensure effectiveness, efficiency, coherence, transparency, accountability and performance of VET policies and systems. In Europe, VET programmes are usually managed by a consortium of the national government, the VET providers, the employers and the national social partners.

SPAIN

In Spain, the responsible bodies are the professional training council, INCUAL, the Ministry of Labour and the Ministry of Education. Most of the training institutions are tripartite with the involvement of the social partners and government bodies, even if the role of the social partners is decreasing.

IRELAND

In Ireland, SOLAS, the Further Education and Training (FET) authority is responsible for planning, co-ordinating and funding FET in Ireland and organizes the apprenticeship system. For the next three years, SOLAS plans to organize 50,000 traineeships and apprenticeships, more than 1,300 of which in the electricity sector.

LATVIA

In Latvia, collegial advisory bodies are established at each vocational-education institution. They are composed of social partners, as well as representatives from local government and a supervising ministry. They make proposals in relation to the development strategy of educational institutions and define VET programmes.

AUSTRIA

In Austria, VET programmes and curricula are regularly developed, updated and adjusted through negotiations between major stakeholders including social partners, which frequently support the coordination process between educational provision and qualification requirements and/or make statements on draft curricula.

CURRICULA, RECOGNITION OF SKILLS AND COMPETENCES

A qualification can be described as the formal endpoint of a process whereby learners have successfully demonstrated to have achieved certain learning outcomes in line with previously expressed standards. When moving to a new job or to further learning, whether within or across borders, learners and workers should see their skills and qualifications quickly and easily recognized. This is a critical issue for the electricity sector and some initiatives have been launched on this.

MALTA

Malta adopts the Malta Qualification Framework (MQF) which is mainly referenced to the European Qualifications Framework (EQF). Malta established its Malta Qualifications Framework (MQF) in 2007 and the National Commission for Further and Higher Education (NCFHE) is the local competent authority for recognizing qualifications and accrediting courses within the Malta Qualifications Framework. The Malta Qualifications Framework is also a referencing tool that helps to describe and compare both national and foreign qualifications to promote quality, transparency and mobility of qualifications in all types of education.

The overall aim of the MQF is to make qualifications more readable and understandable across different countries and systems in Europe.

SPAIN

In Spain, the Certificate of Professionalism is an official accreditation instrument for the professional qualifications in the National Catalogue of professional qualifications in the field of labour administration. These certificates attest to the set of professional competences of a specific work-activity in the production system and this constitutes the regulation of the profession.

They have official status and validity throughout the national territory and are issued by the SEPE and the competent bodies of the Autonomous Communities. They are obtained in two ways:

- Passing all the training modules established within the Certificate of Professionalism.
- Following the procedures established for the evaluation and accreditation of the professional competences acquired through work experience or non-formal training pathways.

The overall aim is to improve the quality of the training and provide workers with an official certificate of qualification.

LEVEL OF PARTICIPATION IN VOCATIONAL EDUCATION

In 2015, it was estimated that nearly half (47.3%) of all upper-secondary students in the EU were enrolled in vocational programmes. In 2015, the Czech Republic had the highest share of upper secondary students in the VET stream at 73.2%. Finland, Croatia, Austria, Slovakia, the Netherlands and Slovenia reported more than 65%. In particular, in Austria, more than 75% of young people in the tenth grade (i.e. one year after the end of compulsory schooling) attend a VET pathway.

Malta (12.7%), Cyprus (15.6%), Hungary (23.2%), Lithuania (26.8%) and Greece (29.9%) had the lowest shares (all below 30% in 2015)[11] .

NATIONAL PECULIARITIES OF VET SYSTEMS IN EU COUNTRIES

As described above, VET systems in EU countries have national peculiarities that apply to the electricity sector.

THE DUAL VOCATIONAL SYSTEM: EXAMPLES OF GERMANY AND SPAIN

In Germany, the dual system is the core of VET. The system is described as dual because training is conducted in two places of learning: companies and vocational schools. In the dual system in Germany, apprentices attend part-time vocational school one or two days per week, where they are mainly taught theoretical and practical knowledge related to their future occupation. For the rest of the time, training positions are offered in both private and public enterprises, and, to a very limited extent, in private households. This dual system is very popular in Germany and around two thirds of all students leaving school go on to start a vocational training programme .

In Spain, all VET studies include a compulsory work-placement module that takes place in a company. But in recent years, alternative training models have been introduced. Dual VET takes two forms: training and apprenticeship contracts, which can be delivered by the education and employment systems and dual VET projects offered within the education system and implemented by the regions.

[11] http://www.cedefop.europa.eu/en/publications-and-resources/statistics-and-indicators/statistics-and-graphs/indicator-overviews

APPRENTICESHIPS: EXAMPLES OF NORWAY AND SLOVENIA

Norway has a well-developed upper-secondary VET apprenticeship system which enjoys a high degree of confidence among stakeholders. In fact, half of the students enroll in a vocational programme, which is organized in school for two years, followed by a mandatory apprenticeship for two years in a company. In this system, the apprentice is contractually linked to the employer and receives remuneration—a wage or an allowance. The employer assumes responsibility for providing the trainee with training leading to a specific occupation.

In Slovenia, where the level of participation in vocational education in the electricity sector is very high, apprenticeships were introduced in 2017 into the vocational education system. According to the new law, apprenticeships are applied to upper-secondary three-year VET programmes and continuing vocational education and training. The apprentices have the status of secondary-school students with placement training representing at least 50% of the education course. Involvement in apprenticeships will not be mandatory for either students or employers.

ITALY AND THE ALTERNATIVE SCHOOL-WORK PROGRAMME

Since 2015, the alternative school-work programme has been compulsory for all students in the last three years of upper secondary schools. In technical and vocational schools, students have 400 hours a year of on-the-job training experience spent in a company. This programme can be arranged either during the school year or in the summer, and even take place abroad. To aid its implementation, the law foresees the creation of a national repository of companies and organizations that offer places for school-work alternating programmes.

VOCATIONAL EDUCATION IN THE ELECTRICITY INDUSTRY: EXAMPLES OF SOME CAREERS IN EUROPE

VET systems vary in each country in Europe and we find the same diversity in the electricity sector.

Let's turn now to some career-based examples.

HOW TO BECOME A MAINTENANCE/INSTALLATION ELECTRICIAN? EXAMPLES OF FRANCE AND THE UK

In France, the diplomas required to work in this occupation vary according to the complexity of the installation. At secondary-education level, the first level of qualification is the Professional Skills Certificate (EQF level 3) on the preparation and realization of electrical works following a school-based vocational programme. At a higher level, a student can get a vocational baccalaureate (EQF 4). At post-secondary level, a student can study for an advanced-technician certificate (EQF 5) or a master of engineering degree in electricity, applied mathematics, etc. This offer is limited by the difficulty in finding a company for the vocational part of the program.

In the UK, a student can enroll in an apprenticeship to first complete the Level 3 Electrotechnical Qualification, Installation or Maintenance. This qualification includes workplace training, a knowledge-based and practical programme in a training provider or college. Once all training that makes up the apprenticeship qualification has been completed, apprentices can apply to take the synoptic end-point assessment—AM2. AM2 is an independent stand-alone assessment that is already well recognized in the industry. Satisfactory completion of the qualification and AM2 will demonstrate full competence and lead to the award of the apprenticeship certificate.

HOW TO BECOME AN ELECTRICAL ENGINEER? EXAMPLES OF BULGARIA AND POLAND

In Poland, the student follows a two-year full-time programme at in a university of technology, after a bachelor degree in electrical engineering or a related field.

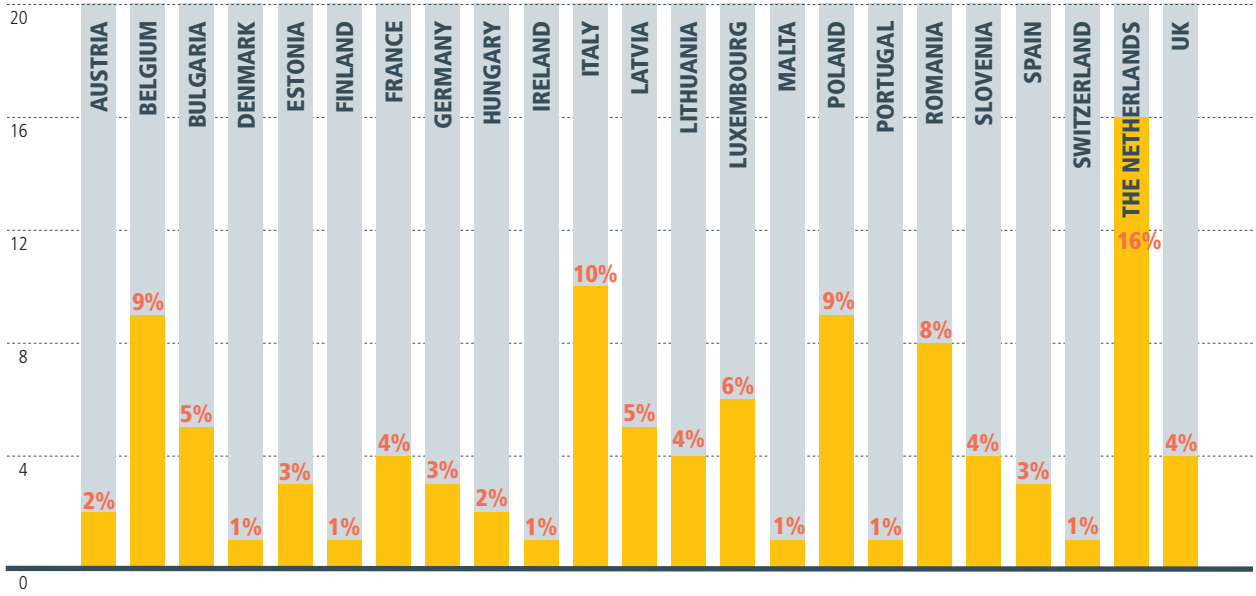
In Bulgaria, getting a qualification as an electrical engineer usually requires a five-year master's degree but a dual-education pilot programme has been introduced in some technical universities.

6.2 MAPPING OF VET PROVIDERS IN THE ELECTRICITY SECTOR

As a first step in this research, mapping of VET providers in the electricity sector lead to the identification of 188 representative VET providers distributed in 23 European countries.

FIGURE 6.2

DISTRIBUTION (%) OF VET PROVIDERS MAPPED IN THE STUDY / COUNTRY (HISTOGRAM)



DESCRIPTION OF VET PROVIDERS (ISCED)

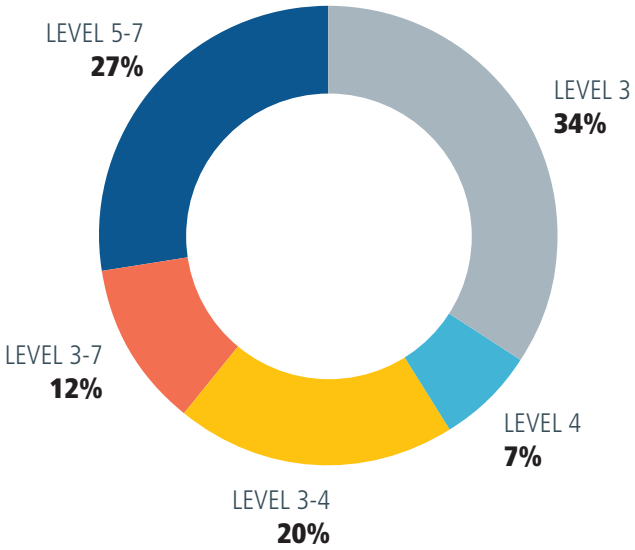
As described above, the VET providers can be classified according to the level of the vocational education and training offered:

- Upper-secondary education (ISCED 3);
- Post-secondary education (ISCED 4);
- and tertiary-education level (ISCED 5-7);

As described in the previous chapter on VET systems, most VET providers mapped in the electricity sector offer courses at upper-secondary education level (ISCED 3).

FIGURE 6.3

FIGURE WITH LEVEL OF EDUCATION OF VET PROVIDERS / ISCED LEVEL



7. PART III
SKILLS GAP ANALYSIS

7. PART III - SKILLS GAP ANALYSIS

Identifying the gap between the skills expected for occupations in the future and the offer from the VET system across Europe is a crucial step towards the responding to the changes in the electricity sector.

As a final stage of the study, after identifying the forecast on skills and competences for 15 occupations, and after mapping 188 VET providers across Europe, we aimed to answer the following key questions*: are Vocational Education and Training providers matching future demand in skills needs in occupations? Where are the main gaps in the VET offer?*

The analysis focused on a set of 45 skills that will either be in greater demand or that are entirely new, as identified by the previous survey in the research.

The results presented in this part of the report were elaborated using two different approaches: a gap analysis approach for 22 skills and a more qualitative analysis for 23 skills since this latter group resulted from self-specified answers and were therefore not ranked in order of priority or relevance by the respondents.

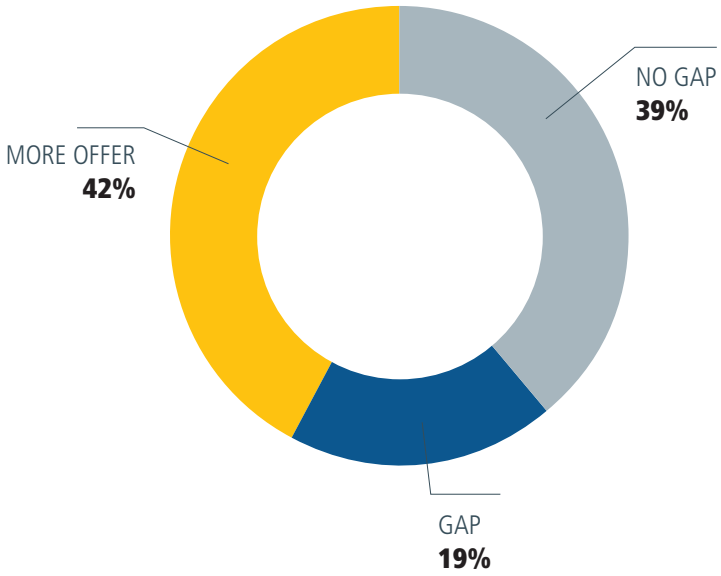
The methodology used for the analysis is described in detail in Annex 1 of the report.

7.1 MAIN FINDINGS

According to replies to the survey of VET providers, the current offer in education and training matches the demand for future skills needs for only 39% of the needs (Fig.7.1) whilst, in 42% of the skills sampled, VET providers are offering more than needed.

FIGURE 7.1

SKILL NEEDS AND VET OFFER: OVERALL MATCH



Source: Elaboration of data from project research activity.

Technical specialized skills related to *renewable-energy technologies* in part match or are currently being "offered more" in educational programmes than required. The same for technological/ digital skills associated with *specific computers* and *using and interpreting a wide range of electric data.* On the other hand, the most significant skills gap is in technological/ digital skills for *storage technologies* and *big data analytics* (Fig.7.2).

At an occupation level, *Commerce and Trading* occupations result to be the ones with highest "imbalances" in the VET offer which means that the educational programmes are not effectively responding to the expected skills needs forecast. Following this, *Back office employees, Operation and Maintenance,* and *ICT Specialists* result as the occupations with highest imbalances (Fig. 7.3).

When analyzing overall results from a skill-category perspective, *technological and digital* skills is the category with the highest gap in the VET offer, nearly twice as high as the average value. *Specialized Technical skills* don't present gaps but overall imbalances are still high due to an overestimated VET offer. (Fig.7.4)

The second sample of skills, named "new skills" in the report, was analyzed with a more qualitative approach since we didn't have the quantitative information that characterizes the relevance of the skill in the near future.

FIGURE 7.2

SKILL MATCH - GAP ANALYSIS

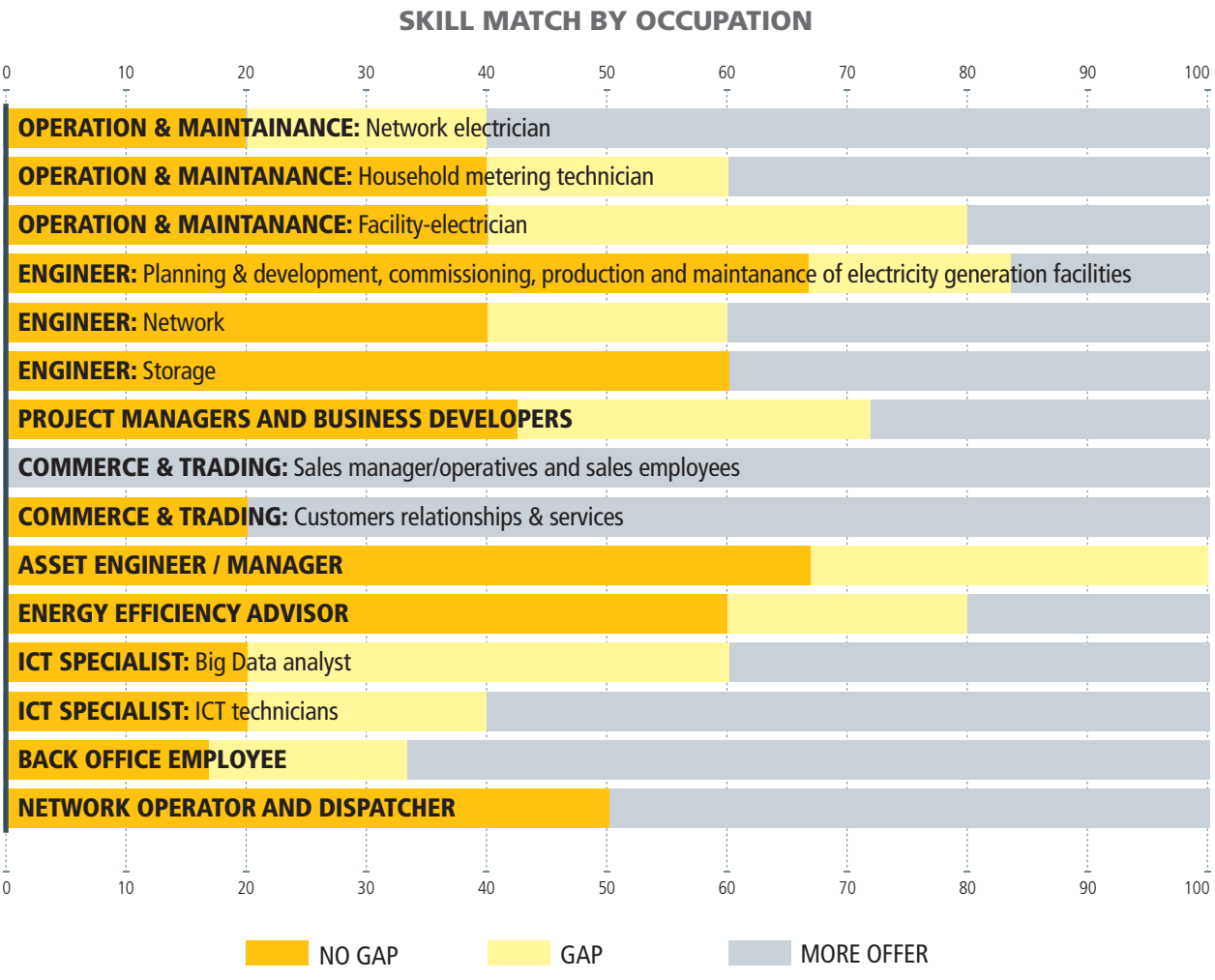
Overall, the current VET offer in the sector appears not to include most of the new skills identified in its educational programmes: roughly 60% of skills are offered by just 25% of VET providers.

Internet of Things is the most transversal "new skill", expected to be needed in 40% of the 15 occupations investigated, followed by *Automation and Artificial Intelligence, Smart Grid*, and *Cyber Security (*Fig. 7.5).

Within Technology and Digital skills, *automation and controlling* and *home automation* have a high take-up in the VET current offer, whilst *fiber-optic maintenance*, *computer systems & network system integration, data owner* and *drone piloting* are not included at all in the curricula set by VET providers (Fig. 7.6)

Marketing skills, mainly referring to *Social selling, Scrum Master* and *Customer Journey* skills, are not currently offered in 7 out of 8 sectoral occupations where these needs are anticipated.

FIGURE 7.3



Source: Elaboration of data from project research activity

FIGURE 7.4

SKILLS NEEDS AND VET OFFER: MATCH ANALYSIS

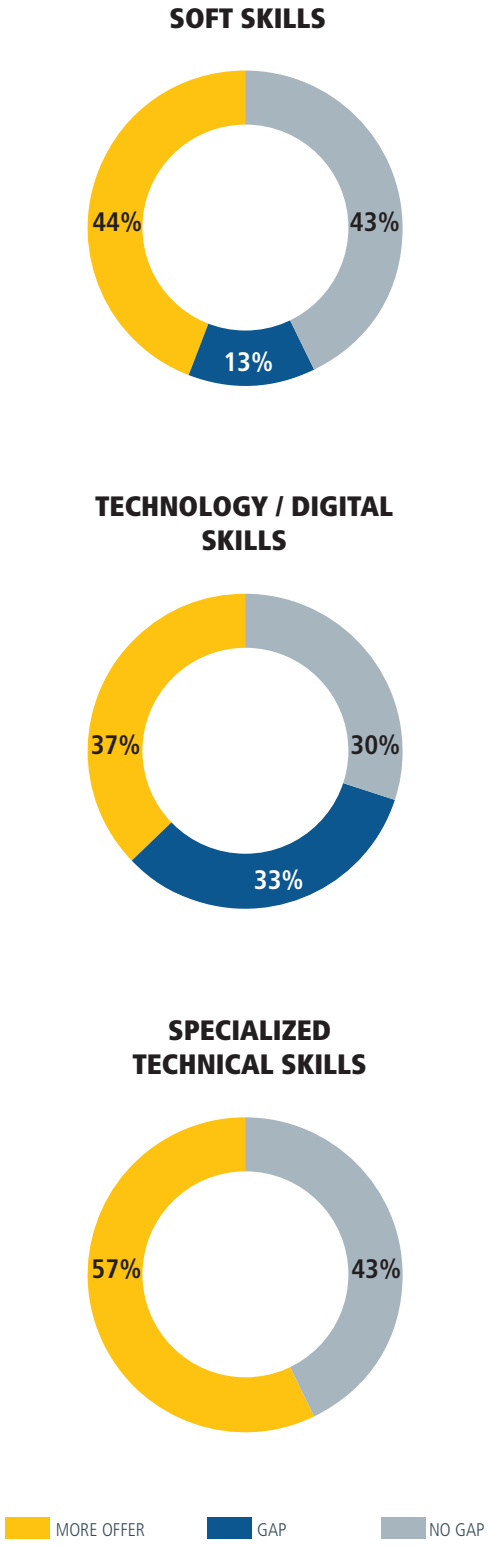
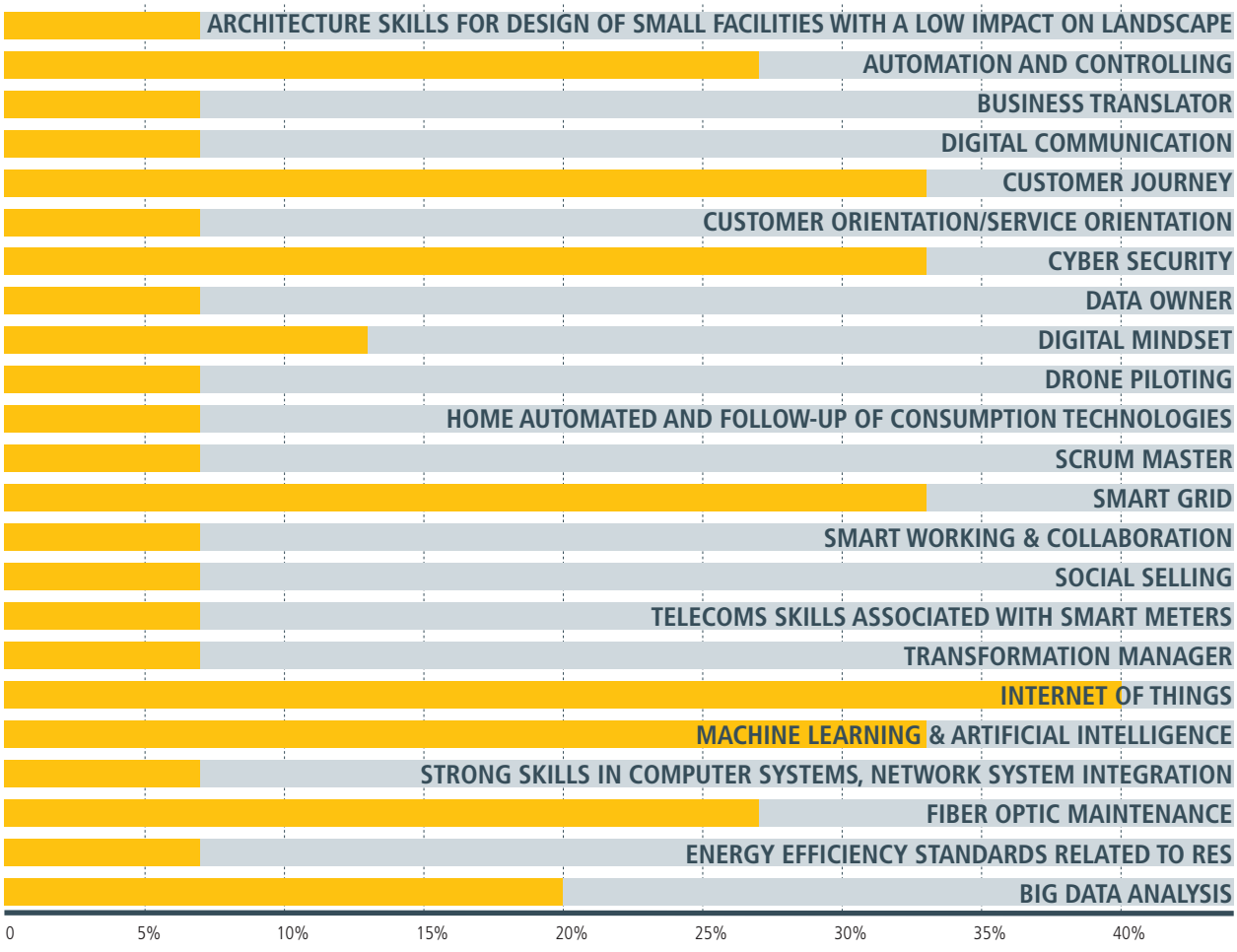


FIGURE 7.5

REPRESENTATIVENESS OF NEW SKILLS IN OCCUPATIONS
(%)

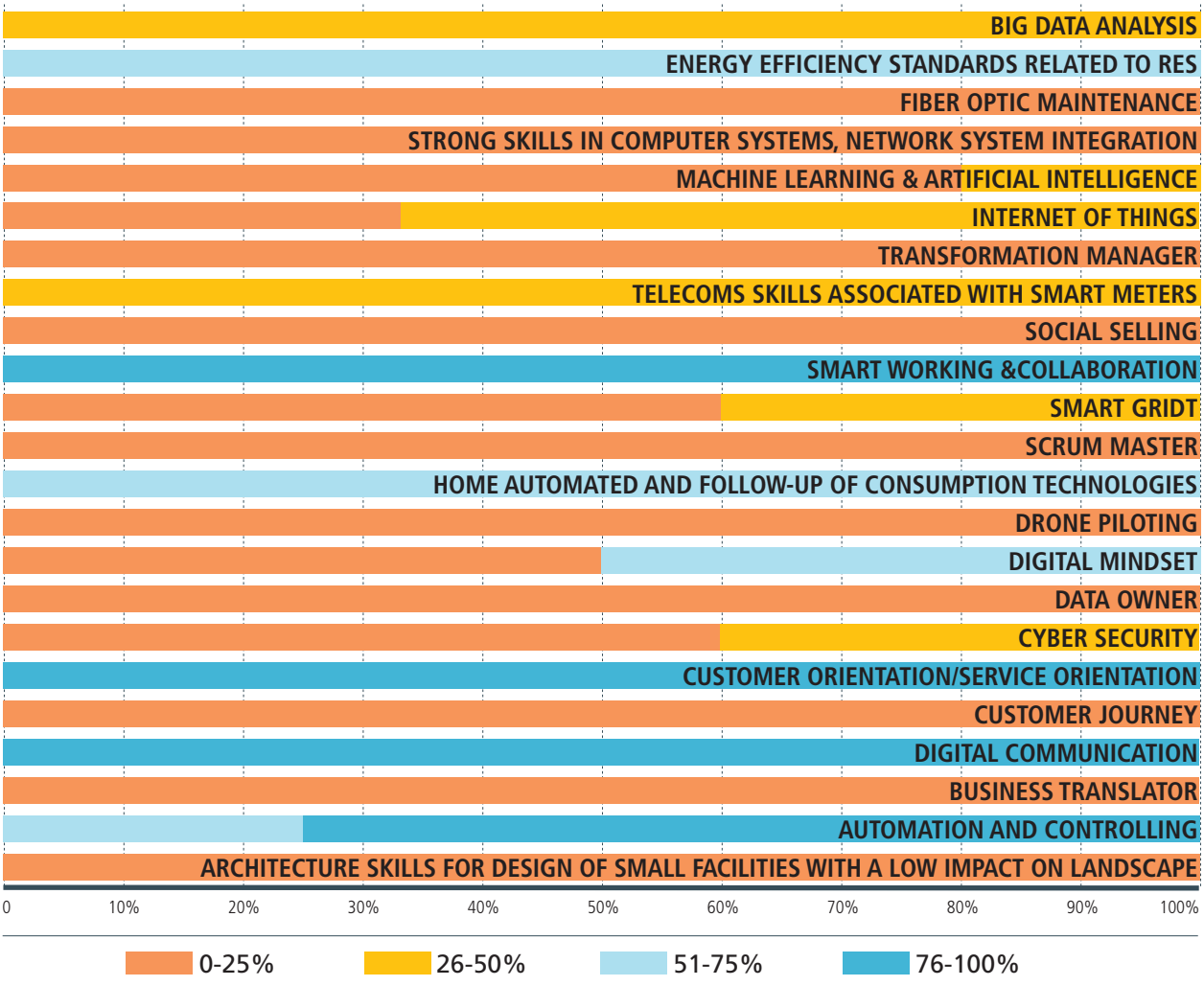


Source: Elaboration of data from project research activity.

FIGURE 7.6

NEW SKILL OFFER: REPLIES OF VET PROVIDERS

(%)



7.2 MAIN CONCLUSIONS

According to the gap analysis, a number of conclusions stand out:

- The current VET offer does not appear to effectively respond to future expectations in skill developments in the sector; more than 60% of the expected needs do not match the VET offer due to skill gaps or a higher-than-required VET offer.

- The greatest deficiency in VET provision of "new-skills" needs appears to be for *Marketing* and *Technological/ Digital* skills. The current VET offer doesn't seem to have yet included the new skillset in their programmes (response rate below 25% for more than 50% of the skill sample).

- Overall the main gaps are associated with *Technological and Digital* skills, nearly twice as high compared to the average value of the sample. *ICT Specialists-Big Data* and *Project Managers and business developers* are the occupations that have the largest gaps (100%).

- Within the new skills needs, *Internet of Things* is expected to be the most horizontal across different occupations, followed by *Automation and Artificial Intelligence*, *Smart Grid*, and *Cyber Security*.

- Conversely, the VET offer seems to be higher than the anticipated demand in the case of *Technical Specialized skills* mainly associated with renewable energy technologies and quality and efficiency standards.

- The VET offer for *Soft Skills* in many cases appears to be higher than anticipated demand, particularly where associated with technical-specialist occupations such as engineering categories and operational technicians.

8. BEST PRACTICE

8. BEST PRACTICE

Part of the research activity developed during the project was aimed at identifying what is being done in terms of innovative tools in VET systems, effective national and regional training programmes as well as methods to monitor skills needs and address skill mismatches and gaps.

8.1 MEETING SKILLS NEEDS

Meeting skills needs in education presupposes an understanding of what the labour market requires.

The management and organization of training systems through public-private partnerships that assure updated contents of training is therefore a key action to match skill demands from the labour market.

1. SPAIN: NATIONAL REFERENCE CENTERS (CRN) FOR PROFESSIONALS IN THE ELECTRICITY SECTOR

DESCRIPTION:

National Reference Centers (CRN) are public centers for innovation and experimentation in the field of vocational training. They are centers where specific sectoral training is provided and serve as a reference point to other education centers and companies in the sector. There are two centers, one for engineers and the other for renewable energy in Navarra. They are considered a main point of reference for professional education.

OBJECTIVES:

Among other relevant objectives, the principal aim is to observe the evolution and the qualification needs of the production system and to contribute to updating and developing vocational training. One of the aims of the Center is to adapt vocational training to those necessities.

PROBLEMS ADDRESSED

- Skill mismatches and new skills requirements
- Transition between education and work
- Training quality

DESCRIPTION PARAMETERS

Actors Involved
The Board members are from trade unions and employers' associations (social partners) and public administrations.
Barriers to Implementation
The necessary infrastructure to offer training in this sector (lines, substations, etc…) is very costly and, in many cases, the funding for these centers is insufficient.
Specific Benefits
The centers offer high-quality training that satisfies the demand from companies but there are not many employment opportunities afterwards.

2. THE NETHERLANDS: STICHTING BLEI FOUNDATION

DESCRIPTION:

Stichting BLEI is a national legal entity, with a board consisting of representatives from the sectors concerned. This foundation is a partnership between sectors of network, heat distribution and water companies and contractors.

In a public-private collaboration of the eleven regional education centers, or ROCs, which are structurally active in the vocational qualification with a broad representation of network companies and contractors. The current learning resources are adapted to the requirements of the new vocational qualification.

OBJECTIVES:

The business community represented in BLEI aims to provide uniform teaching materials and exam products for the eleven educational institutions. In this way, we get a nationally equivalent education for developing skills, attitudes and behavior. This collaboration also focuses on increasing the inflow of students as future technicians.

PROBLEMS ADDRESSED

- Skill mismatches and new skill requirements
- Transition between education and work
- Inclusion of young workers in the electricity sector
- Non-adequacy of sectorally oriented VET programmes

DESCRIPTION PARAMETERS

Actors Involved
Companies and educational institutions.
Specific Benefits
A nationwide network of infrastructure-training courses, which contain the same educational content independently of the educational institution.

3. BULGARIA: CEZ GROUP ACADEMY FOR UNIVERSITY STUDENTS

DESCRIPTION:

CEZ Group is an established, integrated electricity conglomerate with operations in a number of countries in Central and South-Eastern Europe and Turkey, headquartered in the Czech Republic. The Academy provides training and seminars to students studying in the field of energy and utilities in order to introduce them to the realities of the energy and utilities sector and to attract them to the company (generally as interns).

OBJECTIVES:

Provide students with first-hand experience in electricity infrastructure and help them to implement their skills and knowledge; attract them to CEZ Group as a potential employer after their graduation.

PROBLEMS ADDRESSED

- Skill mismatches and new skill requirements
- Transition between education and work
- Inclusion of young workers in the electricity sector
- Non-adequacy of sectorally oriented VET programmes
- Skills recognition and transferability

EVALUATION CRITERIA

Achieved results
95 participants, 15 of them are now employed full-time in CEZ Group Bulgaria.
Cost Linked with the Actions
5,000 BGN / € 2,557 for each student.
Replicability of The Proposed Approach
High: necessary to develop competences and skills to be tested and promoted.

DESCRIPTION PARAMETERS

Effectiveness
Long-term preparation and supply of technical specialists with secondary education, it reduces the recruitment and on-boarding period for new employees.
Actors involved
Partner universities, HR and other areas.
Specific Benefits
Reduces the recruitment and on-boarding period.
Conditions for success
Well-developed relationships with the relevant universities.
Communication tools
Career forums, Facebook, presentations before students and recruitment website.
Barriers for implementation
Curriculum not adapted to the realities and new specifics of the field, lack of practical experience, lack of motivation amongst the students.

8.2 VET SYSTEMS

A quality and structured VET offer, from upper-secondary level to tertiary-level education is a key issue to ensure the update in skills and to maintain a skilled workforce.

1. GERMANY: CRAFTWORK APPRENTICES

DESCRIPTION:

Germany's dual system of vocational education and training (VET) is highly acknowledged. The majority of Germany's workforce received its higher qualification through the dual VET system. The dual VET system is an integral part of the general education and training system in Germany. The German apprenticeship system is called a "Dual System" because training takes place both in firms and public training schools. Germany's apprenticeship system provides 344 certified occupations, designed by the government and industry. The average apprenticeship period is 36 months and the average age of a graduate apprentice is 22. Apprentices are on average 19,5 years old when they begin their vocational training. The remuneration paid by the company is approx. one third of the salary of a skilled worker.

OBJECTIVES:

- Update skills and address skill demand from the labour market
- Quality training offered to students

PROBLEMS ADDRESSED

- Ease of transition between education and work
- Young workers' qualifications entering the labour market

EVALUATION CRITERIA

Achieved Results

- More than 1.4 million apprentices support German companies, 83% in companies with less than 500 employees. Companies with 50 to 499 employees have the largest amount of apprentices.
- On average, one certified trainer trains 2.2 apprentices
- Almost 90% of large companies employ apprentices
- Almost 566,000 signed new apprenticeship contracts. More than 530,000 apprentices take part in final exams, of which 95% successfully pass.

DESCRIPTION PARAMETERS

Actors Involved

Federal Government, Federal States, Industry (Employers, Chamber of Industry and Commerce/ German Confederation of Skilled Crafts)

Barriers to Implementation

Cultural and political background bound to the way in which the education system is organized.

Specific Benefits

For the companies: reduce the time required to train new workers.

For students: achieve high-quality training with skills relevant to the labour market demand.

Conditions for success

The key success factor of the German dual apprenticeship system is the close collaboration between all social partners.

2. SWITZERLAND: THE SWISS VPET SYSTEM

DESCRIPTION:

The provision of VET and professional education is a mission collectively shouldered by the Confederation, the cantons and professional organizations. These partners are jointly committed to the highest possible standard of quality ensuring the skills are updated to those demanded by the market.

OBJECTIVES:

- Update skills and address skill demand from the labour market
- Quality training offer to students

PROBLEMS ADDRESSED

- Ease of transition between education and work
- Young workers qualified upon entering the labour market

DESCRIPTION PARAMETERS

Actors Involved
The Confederation is formed by the State Secretariat for Education, Research and Innovation (SERI) and the Swiss Federal Institute for Vocational Education and Training (SFIVET), the professional organizations are trade associations and companies, social partners, other relevant organizations and VPET providers
Involved Enabling Technologies
E-learning and Learning Management System
Barriers to Implementation
Cultural and political background bound to the way in which the education system is organized.
Specific Benefits
Two-thirds of all young people coming out of compulsory education in Switzerland enroll in vocational education. The Swiss VPET system enables young people to enter the labour market and ensures that there are enough skilled workers and managers in the future. It has high labour-market relevance and is an integral part of the education system. In the French and Italian-speaking parts of Switzerland, the proportion of full-time vocational schools is higher than in German-speaking Switzerland.

3. MALTA: MALTA COLLEGE OF ARTS, SCIENCE AND TECHNOLOGY (MCAST)

DESCRIPTION:

Established in 2001, the Malta College of Arts, Science and Technology (MCAST) is the country's leading vocational education and training institution. MCAST and Reggie Miller Foundation (the educational body of the General Workers' Union) offer tailor-made courses for employees and employers. Reggie Miller can accredit courses up to level V.

OBJECTIVES:

To provide accessible vocational and professional education and training with an international dimension, responsive to the needs of the individual and the labour market.

EVALUATION CRITERIA

Achieved Results
Better employability and skill matching (demand is met for the new skills required).
Cost Linked with the Actions
Costs of the actions are linked to trainer costs and venue and employee cost because training takes place on working time.
The Maltese Government funds such courses so employers have these costs covered.

DESCRIPTION PARAMETERS

Actors Involved
Educational institutes, Government, Employers and Trade Unions.
Specific Benefits
Once employees undergo and achieve the tailor-made course, they are able to:
1. Find work
2. Benefit from an increased salary
3. Be promoted

Barriers to Implementation
Lack of interest from employers.

8.3 WORK-BASED LEARNING METHODS, APPRENTICESHIPS

One ongoing challenge for maintaining the electricity-industry workforce is the amount of time required to train new workers; the European electricity workforce is educated through a variety of means but work-based learning methods such as apprenticeships and internship programmes appear to be the most effective training approach in the sector.

What seems clear from information collected during the project regional seminars, is that leading energy companies have implemented their own apprenticeship programmes due to a lack of uniformity in standards and qualifications that make it difficult for them to ensure that applicants have the necessary skills. Some good examples from energy companies are briefly described.

1. ITALY: THE SCHOOL-WORK- MODEL: APPRENTICESHIP AT ENEL

DESCRIPTION:

The ENEL apprenticeship model was regulated by a collective agreement between the company and trade unions that covered contractual and economic conditions and rights.

The apprenticeship programme implemented was a three-year path structured in 2 phases:

Phase I: a 24-month high-level apprenticeship during the 4th and 5th year of high school (technical institutes) aimed at obtaining the diploma and integration into the business environment. This phase envisages presence in the company of one day a week during the school year and a full-time presence during the summer.

Phase II: technical-practical professional training in the company during the following 12 months for the students who have obtained a diploma and a level of qualification deemed appropriate by the company.

OBJECTIVES:

Create a virtuous circle between education and labour market.

Create school programs that integrate academic learning with professional and technical skills aligned to the needs of the labour market.

Speed up the company's professionalization process, valorizing both school education and training performed during the apprenticeship.

Build an employment path extendable to other companies.

PROBLEMS ADDRESSED

- Skill mismatches and new skills requirements
- Transition between education and work
- Inclusion of young workers in the electricity sector
- Non-adequacy of sectoral oriented VET programmes

EVALUATION CRITERIA

Achieved results
Very good feedback from all stakeholders.
Cost Linked with the Actions
The costs are on companies, mainly on building internal training capacities.
Replicability of The Proposed Approach
High, the model has already been replicated in other SMEs and industrial sectors with the appropriate adjustments.

DESCRIPTION PARAMETERS

Actors Involved
Company, Trade Unions, Students, VET providers, Ministries, Employers' Association.
Specific Benefits
Integration between academic development and working culture.
Conditions for success
Attention to people and company's training investment perspective.
Communication tools
Network with schools, socials, media and local TV educational programmes.
Involved enabling technologies
Berries (iPads) to control and monitor faults.
Barriers for implementation
Difficulties in modifying educational programmes structure; financial investment by companies in tutoring resources.

2. FRANCE: EDF, ERDF, EGDF AND RTE: APPRENTICE PROGRAMMES

DESCRIPTION:

The Group prioritizes apprenticeships through work-study contracts to promote social advancement and recruit new employees at every level of qualification.

The commitments in the Professional Training Agreement (Défi Formation) testify to the Group's plans to develop apprenticeships in France. This agreement includes:

- Stipend to help the apprentice pay his/her housing costs and, if necessary, obtain his/her driving license
- Access to company profit-sharing programmes and all others social benefits
- Follow-up from a dedicated tutor that has been trained and who is rewarded with a form of financial compensation and recognition in his/her skills assessment
- Support for apprentices who are not recruited in finding work outside the company through external partnerships and incentives.

OBJECTIVES:

- Speed up the company's professionalization process, valorizing both school education and training performed during the apprenticeship.
- Provide young apprentices with high qualifications and enhance their professional integration

PROBLEMS ADDRESSED

- Skill mismatches and new skills requirements
- Transition between education and work
- Inclusion of young workers in the electricity sector

EVALUATION CRITERIA

Achieved results

- More than 4% of the Group's employees under work-study contracts at every level of training (exceeding the targets set by the law of 2006).
- 100 apprenticeships offered annually at technical-diploma entry level, with recruitment open to successful participants, whereas EDF had stopped recruiting non-apprentices at this level some years ago.
- At least 25% of recruitment at technician and supervisory level and 4% of executive and engineering recruitment through work-study programs.
- Greater support for apprentices who are not recruited in finding work outside the Group through external partnerships and incentives for assisting these young people.
- Offer employment benefits for apprentices that exceed the regulatory requirements, such as additional healthcare coverage.

DESCRIPTION PARAMETERS

Actors involved

Students, workers, companies and educational institutes

Specific Benefits

In the electricity sector, these programmes, beyond the legal and the Corporate Social Responsibility aspects, also address real skills needs in many areas, mainly energy and technically oriented (electro-technics) skills but also for sales and customer relationship skills.

Communication tools

This agreement is implemented through communications campaigns using various media and various job boards (in-house as well as external) and through partnerships with educational institutes.

ANNEX 1 METHODOLOGY OVERVIEW

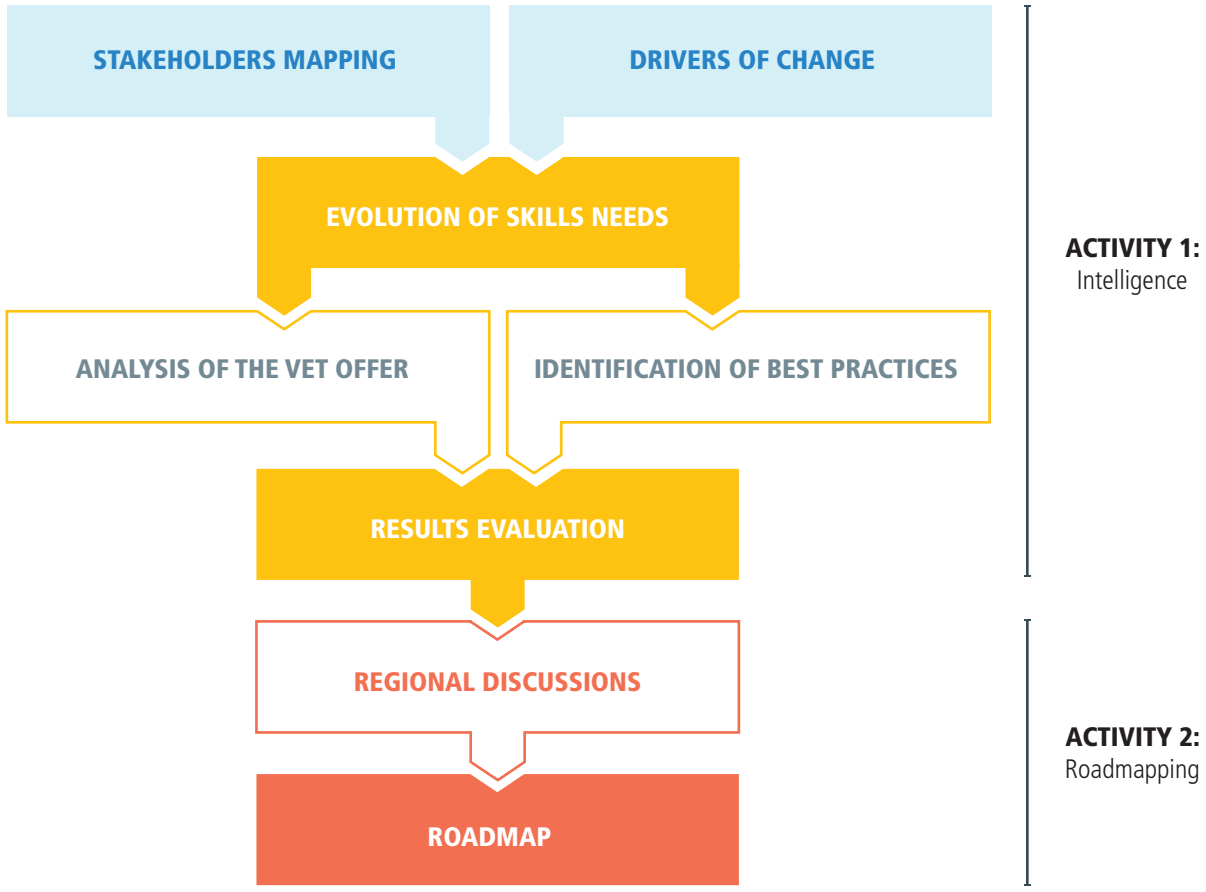
ANNEX 1
METHODOLOGY OVERVIEW

In order to achieve the research objectives, the study was organized in two different steps: the "Intelligence" and the "Road-mapping" activities.

The "Intelligence" activities aim at improving current knowledge of new skills needs, existing VET systems in member states and the current skills and knowledge offer.

The "Road-mapping" activity is focused on identifying priorities and actions in order to support the European and national social partners in the definition of a roadmap on skills and education in the electricity sector.

The following scheme represents the logical structure of activities of the research study.



ACTIVITY 1: INTELLIGENCE DEVELOPMENT

MAPPING STAKEHOLDERS: The first step in the research was to identify target stakeholders from the electricity sector, as a source of information and target audience for the surveys.

DRIVERS OF CHANGES: The three drivers of change have been described and detailed in order to make the survey more understandable and clear to the target audience

EVOLUTION OF SKILLS NEEDS: This activity aimed at identifying the impact of drivers of change on occupations and the relevant skills and qualifications needed. As a first step, the project Steering Committee, together with project experts, identified 15 representative occupations in the sector. An online survey was then launched to target stakeholders.

ANALYSIS OF THE VET OFFER: This activity was developed in two steps: a first survey to map VET providers in the electricity sector and, in a second step, a survey on the skills offer targeting VET providers.

IDENTIFICATION OF BEST PRACTICE: This activity aimed at collecting the most relevant practices in VET and training systems (initial formation, apprenticeships, etc.) in the electricity sector.

EVALUATION OF RESULTS: Data collected during the research was processed and used as the basis for discussion with European and national social partners.

REGIONAL DISCUSSIONS: This activity was aimed at collecting further inputs from national social partners, discussing survey results and identifying regional peculiarities during the three Regional workshops organized during 2017.

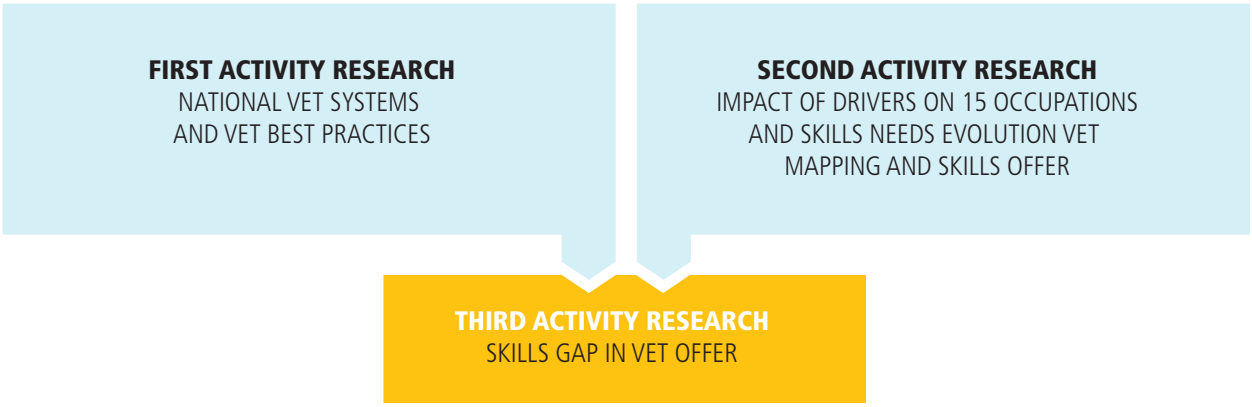
ACTIVITY 2: ROAD-MAPPING

ROADMAP: The aim of this activity is to define priorities, good VET programmes and joint initiatives with the social partners for the coming years, in order to better respond to changes in the electricity sector.

SURVEY AND RESEARCH DESIGN

The dataset that forms the basis of this report is the result of three extended research activities; the report therefore consists of three interrelated parts, providing a uniquely flexible dataset that can be recombined in various ways to obtain further specific insights.

FIG. 1 RESEARCH LOGICAL STRUCTURE



For the purpose of the study different tools were used to collect data:

- Three off-site surveys
- Three regional seminars
- web research and direct consultation of leading European associations that work with VET providers.

The **first research activity** aimed to provide European social partners with a more detailed overview of existing Vocational and Education Training (VET) providers in the sector and collect VET best practices across EU28 countries.

The research targeted 184 stakeholders from leading European employers in the sector and trade unions. The results have been enriched by extensive web research and consultation of leading European associations that work with VET providers (INNOTECS, European network of schools in the technical sector, EFVET European Forum of Technical and Vocational Training).

The survey designed for this purpose was structured in two sections: in the first, we asked respondents to fill in the VET providers database with information and contact details for existing VET providers/higher education institutes that train people for occupations in the electricity sector, and in the second section, we asked them to identify VET best practices at a national level.

The aim of the **second research activity** was to understand, as comprehensively as possible, expectations regarding the impact of drivers on occupations in the sector and the future needs of new skills and competences. This will ultimately contribute to a more informed debate on these issues and provide European social partners with an evidence base and guidance. The target sample of this second research activity was 184 stakeholders from the largest employers in the electricity sector and trade unions across Europe. The results of this research have been enriched with outputs from the national social partners that participated in the three regional project seminars.

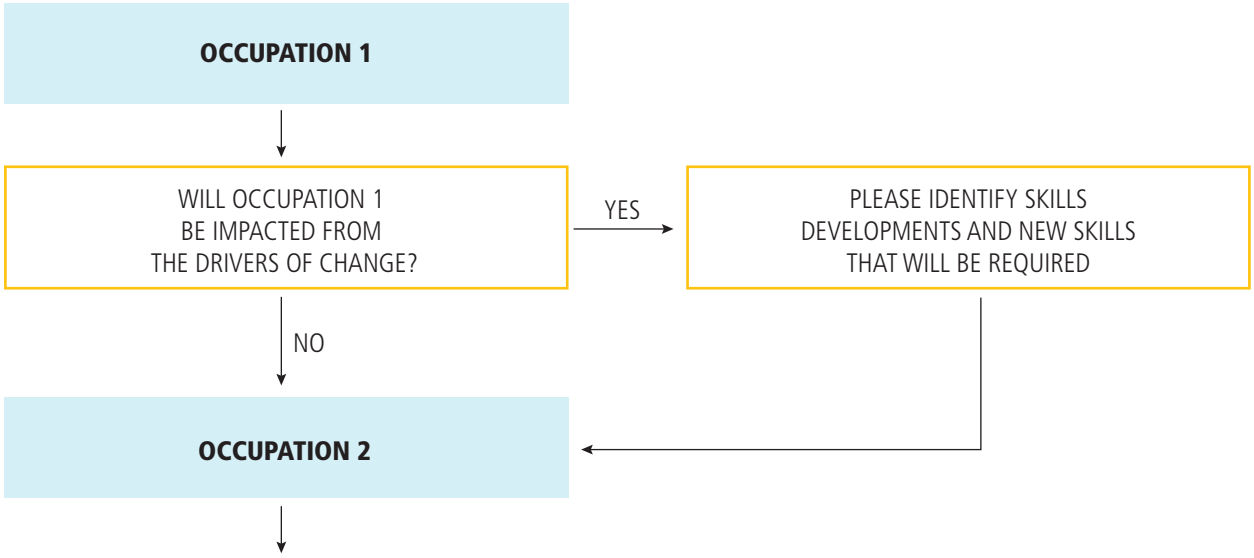
This second survey was carried out via an online tool (Survey Monkey) in order to make the questionnaire more user-friendly and easy to reply to.

The questionnaire was translated into 9 languages: EN, FR, ES, DE, IT, CZ, PL, RO and BL.

The survey largely consisted of *perception-based questions*, designed in two levels (Fig.2): a first question asked if they believed that, in the next 10 years, one (or more) of the three drivers of change would impact on the occupation; and a second level of detail, activated only for positive responses to the first. These asked them to select which new skills would be most required. This second-level question was structured with pre-given response options in a list of 77 skills and competences. In addition, respondents had the possibility to self-specify further occupation-specific skills they considered essential if these did not appear on the list.

In total 41 companies and organizations in 14 EU countries responded to our survey, providing us with 1,035 unique pieces of data on skills development in the electricity sector.

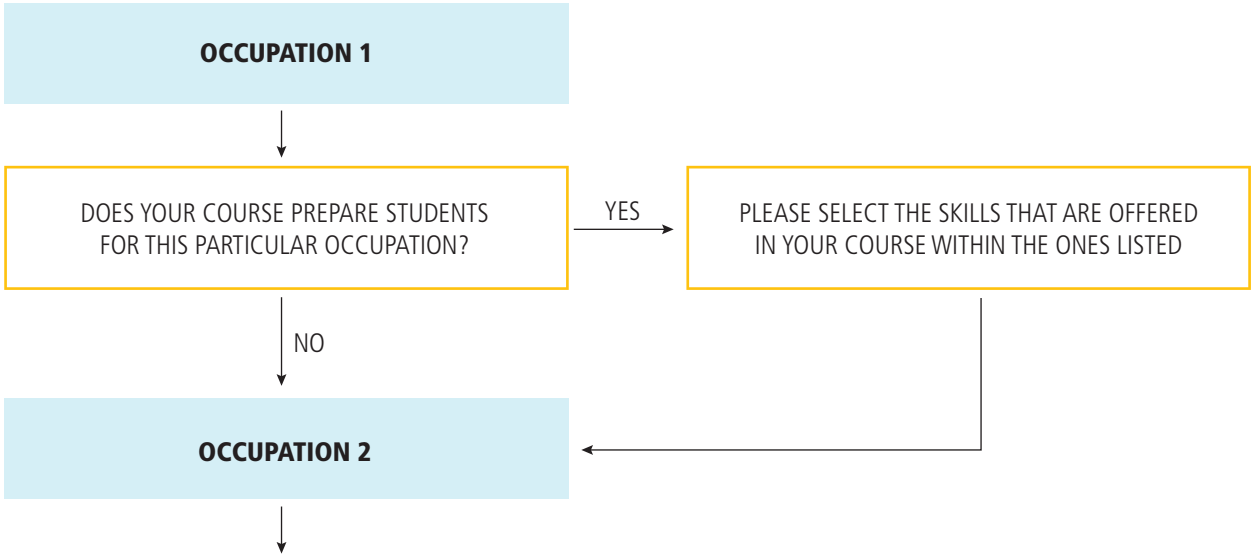
FIG.2: LOGICAL STRUCTURE OF THE SURVEY ON SKILL DEVELOPMENTS



The aim of the **third research activity** was to understand the current Vocational Education and Training (VET) offer, focusing on the skill developments and new skills needs, as highlighted by the second survey, for representative occupations in the electricity sector. In total 45 skills (22 existing skills that will be most needed and 23 new skills) and competences were listed as relevant to respond to changes the sector is undergoing. The target sample for this third research activity were 188 VET providers distributed in 23 European Countries.

To meet this objective, we designed a questionnaire with a structured approach where we listed, for each occupation, the set of relevant skills and competences and new skills identified. We then asked VET providers to select the ones provided in their courses.

FIG.3: LOGICAL STRUCTURE OF THE SURVEY ON VET OFFER FOCUSED ON SKILL DEVELOPMENTS

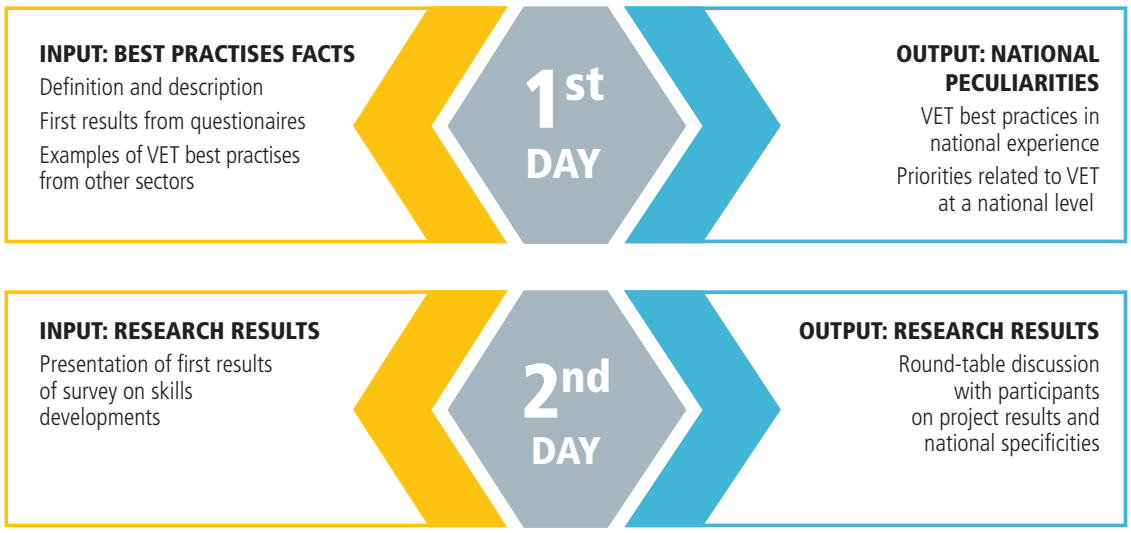


REGIONAL WORKSHOP STRUCTURE

The three workshops were organized in specific regions: Southern Europe, Northern and Central Europe and Central-Eastern Europe. The aim of the workshops for this research study was to collect more responses to our surveys and enrich information with regional peculiarities. The workshops were organized in order stimulate discussion and active participation with group work and presentations on the following issues (Fig.4):

- VET systems at a country level
- VET best practices
- Discussion on first results of surveys

FIG. 4: STRUCTURE OF THE REGIONAL SEMINARS



THE RESEARCH PROCESS

The research activity process was carried out during the year 2017.

As a **final research activity**, through a gap-analysis approach, we identified the skill mismatches between the expected future developments in skills needs in occupations, as a result of the second research activity, and the current VET offer in European countries.

The analysis focused on a set of 45 skills; 22 of which were processed with a gap-analysis approach, 23 were elaborated with a more qualitative approach, since they were self-specified by respondents and it wasn't possible to compare supply and demand in qualitative terms.

The gap analysis approach consisted in populating a first matrix, where the vertical axis are the future skills and the horizontal axis are the 15 occupations, with numbers (from 1 "low" to 4 "very high") that corresponded to the following rates:

- 1: if the skill is expected to be needed by 0%-25% of respondents
- 2: if the skill is expected to be needed by 26%-50% of respondents
- 3: if the skill is expected to be needed by 51% to 75 % of respondents
- 4: if the skill is expected to be needed by 75% to 100% of respondents

A second matrix, with the same structure of axis and ranking correspondence, was populated with replies of VET providers (on the offer side).

The matrix model allows for multiple level-analysis on skills needs/offer: from a skill category level down to the detail of specific occupations.

For the second set of skills, those in the report (§ 7) that we categorized using the term "new skills", were analyzed following a more qualitative-gap analysis approach which consisted in populating the matrix with the ranking quantifications provided by the VET offer.

CLASSIFYING OCCUPATIONS

As a first step in our research, members of the project Steering Committee, together with the project experts, identified 15 representative occupations in the sector.

Occupations were then classified following two different approaches: a first more disseminative and "popular" classification, through the "blue, white and grey-collar" categories, that was used to describe occupation profiles during the regional discussions and therefore also represents the basis for main outputs. For the purpose of the report, the blue/ grey/ white-collar classification was used to discuss results and the key findings (Fig.5).

The second, more official and recognized, classification was made through the ISCO 08 system[12] used in the final report.

[12] ISCO-08 Index of Occupational Titles links job titles that may be used in response to questions on occupation in statistical and administrative data collections. http://www.ilo.org/public/english/bureau/stat/isco/isco08/index.htm

FIG.5 BLUE, GREY AND WHITE-COLLAR CLASSIFICATION OF OCCUPATIONS

CLASSIFYING SKILLS AND COMPETENCES

Unlike occupations, skills don't have a referenced system but only a recognized taxonomy that defines the term as: "the ability to apply knowledge, use know-how to complete tasks and solve problems and carry out the tasks that comprise a particular job". It refers to work-related abilities generally used in the labour market.

The research activity focused, as a starting point, on a core set of 77 skills and competences, both specific and cross-cutting to the 15 sectoral occupations.

For the purpose of the report, the following classification was used to discuss and comment on results and identify main key findings:

- Soft skills: Skills that are cut across many jobs and sectors and relate to personal and social competences
- Managerial skills: skills that relate to the technique, practice or science of managing a company or business
- Technological/ Digital skills: skills needed to efficiently employ information and communication technologies including hardware, data flow, processing and security
- Marketing skills: Ability to promote and sell products and services, including communication, market research, customers relations
- Operational/ Maintenance skills: Mechanical competences including using, installing, programming, tuning machines and equipment and providing preventive and corrective maintenance
- Specialized Technical skills: Knowledge of the practical application of engineering science and technology.

ANNEX 2
LIST OF VET PROVIDERS WHO RESPONDED TO THE SURVEY

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LIST OF VET PROVIDERS WHO RESPONDED TO THE SURVEY

COUNTRY	VET PROVIDER	LEVEL OF EDUCATION	ICSED
DENMARK	Tradium College	UPPER SECONDARY AND POST SECONDARY	ICSED 3-4
LATVIA	Liepājas Valsts tehnikums	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
ITALY	ITST Ercolino Scalfaro	POST SECONDARY	ICSED 4
ITALY	ITT G. Giorgi - Brindisi	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
ITALY	I.I.S.S. Galilei Sani	POST SECONDARY	ICSED 4
ITALY	ITI Vittorio Emanuele III	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
ITALY	I.T.S.T. J.F.Kennedy	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
ITALY	I.I.S.Alessandrini-Marino	POST SECONDARY	ICSED 4
ITALY	ITT B. Focaccia	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
ITALY	IIS Amedeo Avogadro	POST SECONDARY	ICSED 4
ITALY	I.I.S. Luigi Di Savoia	POST SECONDARY	ICSED 4
ITALY	IIS A. Pacinottil	POST SECONDARY	ICSED 4
SPAIN	Politeknika Ikastegia Txorierri	UPPER SECONDARY LEVEL EDUCATION, POST SECONDARY & TERTIARY	ISCED 3/7
AUSTRIA	MCI Management Center Innsbruck	TERTIARY LEVEL	ICSED 5-7
LUXEMBOURG	LTPEM	UPPER SECONDARY LEVEL EDUCATION -	ICSED 3
NETHERLANDS	BLEI, Branchesamenwerking Leermiddelen en Examenproducten Infratechniek	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
FRANCE	CFA métiers de l'énergie	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
LUXEMBOURG	Lycée Technique d'Esch-sur-Alzette	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
BELGIUM	ECS	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
FRANCE	Institut des métiers ENR / ENGIE	UPPER SECONDARY LEVEL EDUCATION, POST SECONDARY	ISCED 3/4
FRANCE	Ifa Chauvin	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
ROMENIA	Technical College Dimitrie Leonida	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
ROMENIA	Liceul Tehnologic "Nikola Tesla"	UPPER SECONDARY LEVEL EDUCATION	ICSED 3
BULGARIA	Technical University of Sofia	TERTIARY LEVEL	ICSED 5-7
BULGARIA	Technical University of Gabrovo	TERTIARY LEVEL	ICSED 5-7
NORWAY	Electric energy company		
SWEDEN	National agency for Education		

EPSU
EUROPEAN PUBLIC SERVICE UNION

eurelectric

industriAll
EUROPEAN TRADE UNION

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