



European Network of Public Employment Services

Greening of the labour market – impacts for the Public Employment Services

Small scale study

June 2021

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LIST OF ABBREVIATIONS

ALMP	Active Labour Market Policy
ANEQP	National Agency for Qualification and Professional Education
BL	Benchlearning
Cedefop	European Centre for the Development of Vocational Training
CEPA	Classification of Environmental Protection Activities
CReMA	Classification of Resource Management Activities
DG EMPL	Employment, Social Affairs and Inclusion Directorate General
EaSI	European Programme for Employment and Social Innovation
EGSS	Environmental goods and services sector
EC	European Commission
EMCO	Employment Committee
EU	European Union
EURES	European Employment Services
ESF	European Social Fund
EFFAT	European Federation of Food, Agriculture and Tourism Trade Unions
ETUC	European Trade Union confederation
GDPR	General Data Protection Regulation
GMI	Guaranteed Minimum Income
IAP	Individual Action Plan
ILO	International Labour Organisation
IndustriAll	European trade union federation
IRENA	International Renewable Energy Agency
JIA	Job Integration Agreement
LTU	Long-Term Unemployed
MSs	Member States
NACE	The Statistical Classification of Economic Activities
N/A	Not Available
NGO	Non-Governmental Organisation
Onemev	National Observatory for Jobs and Occupations of the Green Economy
PES	Public Employment Services
SPOC	Single Point of Contact
UI	Unemployment Insurance

EXECUTIVE SUMMARY

The greening of the economies is likely to be speeded up as the EU with its European Green Deal and Member States have committed themselves to move towards a green and climate neutral economy. Supporting the green transition of the economy has been an element of the recovery plans to cope with the COVID-19 crisis. Public Employment Services (PES) will be key actors in mitigating the negative labour market effects and in smoothing the transition towards a greener economy.

What are green jobs?

There is no common definition of green jobs. Depending on the policy priorities, different sectors or policies have been focussed upon, referring to notions such as green economy, low carbon economy, circular economy, greening transition, sustainable development, environmental sustainability. It still needs to be clarified what to include in the measurement of a green economy. Accordingly, green jobs are defined more or less broadly across EU MSs. In some cases, green jobs are identified in relation to specific sector. Other cases, the definition is based on activities across sectors.

A distinction between 'green' and 'greening' jobs or 'hybrid jobs' has been made in some MSs (e.g., France, Italy). The notion of 'green occupations' may include those whose purpose is to improve the environment. The notion of 'greening occupations' or 'hybrid' jobs would include occupations whose finality is not environmental, but which have an environmental component and integrate (new) 'skills building blocks' to take into account the environmental dimension.

Consequently, the assessment of the volume of green jobs (between 0.3% and 8% of those employed) and greening jobs (up to 14% of all employed) varies widely across EU MSs and across studies. Common features indicate that today, green jobs are more often performed by men than women, probably more often by younger workers.

For PES it is decisive to grasp the structural changes associated with a transition towards a green economy. In several EU Member States, PES have been involved in identifying green and greening occupations and to establish corresponding occupational profiles according to PES or national classification of occupations. A few PES have worked in partnership with other key stakeholders (for example ministry of ecological transition, observatories). Defining green occupations and identifying greening occupations is important for placement activities as well as for providing vocational guidance and career advice for young people and adults, as well as targeting and planning training/retraining programmes.

What is the labour market impact of greening the economy?

While there are differences in the estimated employment impact of a move towards a green economy, available studies carry two main messages: employment effects are likely to be slightly positive, or roughly neutral; however, shifts across sectors and occupations will be sizeable. The agricultural and energy sectors may be among the most affected. It is also expected that the construction industry will see employment gains, but new skills and knowledge will be required. A circular economy scenario would increase the number of jobs mainly in the area of sewage and waste. An electro-mobility scenario would engender losses of conventional blue-collar mechanical jobs in the automotive industry. As a general trend the greening of the economy will further push the already existing trend towards digitalisation.

The impact on skills is assessed to be manifold: (i) small adaptation of skills within existing occupations; (ii) substantial skills adaptation and/or extending skills basis to render

occupations 'greener'; (iii) emergence of new occupations; (iv) growth of green occupations and thus increasing demand for specific skills related to these occupations; (vi) decline of occupations with skills no longer in demand. A key challenge consists in skills adaptation and upskilling through the inclusion of new skills into existing skills sets as well as to identify the transferability and portability of skills from one occupation to another. These skills can be specific technical skills as well as generic (or so-called 'soft') skills.

The transition to a greener economy will have an impact on workers at all skill levels. Skills profiles for green and greening jobs tend to focus in the short term on the medium skill level. In the long term a trend towards more demand for high skilled workers can be expected. The impact of the green transition on labour markets can however vary quite widely across regions and labour market segments. For some labour market segments and local areas there is a risk of skills mismatch paving the way for structural unemployment.

Typologies for greening labour markets and implications for PES activities

The greening pathways and the speed of transformation will depend mainly on the following drivers for change: political commitment and policy focus, changing consumer behaviour, room for local political commitment as a basis for bottom-up transformation, the role of technology-driven transformation (e.g., digitalisation, engineering solutions, techniques for implementation). The endowment of the regional and local economy with physical, human and natural capital and production factors will also influence the pathways, challenges and opportunities for greening labour markets.

Taking these different drivers of change and structural factors into account, **a typology of five greening labour markets** can be disentangled: technology intensive green labour markets, labour intensive greening labour markets, disruptive greening labour markets, repair and preserve greening labour markets and evolutionary greening labour markets.

While in reality local labour markets may show characteristics of several typologies, the typologies help to show different types of challenges and opportunities and, consequently, differences in the focus of PES activities.

Conclusions and the way forward for PES

An ambitious ecological transition will call for a shift in the focus of PES activities towards skills profiling, identifying transferable skills, vocational guidance, upskilling and retraining measures at all skill levels, including for the low-skilled. Close cooperation between PES and employers, sector associations, training institutions, universities and research centres is key to grasp the type of skills needs, required skills adaptations and need for upskilling in specific occupations. A few PES have already started to improve labour market information system accordingly. Looking forward, many PES would need to improve their labour market information systems to increase the transparency on green jobs and skills. PES staff would need more training and higher awareness to use all available information on green and greening jobs and skills. Close cooperation with other partners specialised in identifying the transferability and portability of skills would increase PES capacity to accompany the green transition on the labour market. PES and their partners can build on some experiences gained in identifying transferability of green skills and setting up targeted training measures implemented by PES in a few Member States (examples are given in this study).

In addition to training measures, PES will also need to have other active labour market programmes in place, targeted at those who cannot be upskilled or reskilled. As in the past, direct job creation measures and public works with a social and ecological objective offer the possibility to integrate vulnerable groups. PES can build on experiences gained in mostly small-scale and innovative ALMPs implemented in the past, as shown in this study.

It is also recommended that PES improve matching for green and greening jobs by using technology and improving the skills taxonomy. Cooperating with private employment services and actively collecting vacancies in the area of the green economy through cooperating with employers, employer federations and chambers of commerce, industry and crafts will increase the effectiveness of employment services provided by PES.

Some PES have started to include the transition towards greening labour markets in their strategies, and/or have started to implement specific activities to raise awareness among PES staff. Increasing staff capacities is crucial in light of the increased volumes of job creation and job destruction linked with the transition towards greening labour markets.

1. INTRODUCTION

1.1 Background and objective of the study

Greening of the economies has already been one of the drivers of structural changes for a while, and the process is likely to be speeded up as the EU and Member States (MSs) have committed themselves to move towards a green and climate neutral economy.

In December 2019, the European Commission (EC) presented the European Green Deal, a roadmap towards a climate-neutral circular economy¹. The EC has accordingly started to adopt strategies and funds, including the presentation of the European Green Deal Investment Plan and the Just Transition Mechanism on 14 January 2020, the adoption of the European Industrial Strategy on 10 March 2020, the Circular Economy Action Plan on 11 March, the 'farm to fork' strategy and the EU biodiversity strategy on 20 May and EU strategies for energy system integration and hydrogen in July 2020. The strategies and action plans focus on sectors where the potential for circularity is high. Supporting the green transition of the economy has been an element of the recovery plans to cope with the COVID-19 crisis in a number of Member States.

Greening economy measures in national stimulus programmes for post-COVID-19 recovery

Among countries that have announced larger budgets for the green economy in their stimulus packages are Germany, followed by France, where 30% of the stimulus package is earmarked for ecologic transition², Denmark and Norway (source: mainly Bloomberg NEF, government announcements, media reports³).

A study by Rhodium Group, taking a relatively narrow definition of stimulus spending across major economies, found that the EU has allocated around 15% of spending to green, climate-related priorities as compared to 1.1% in the US (green stimulus funding in recovery plans in the EU exceed US funding by six times) (Rhodium Group, 2021⁴). In addition to financial support, changes in the regulatory framework are also likely to have an impact on producers' and consumers' behaviour (OECD, 2020).

There is no encompassing overview of the funding for green economy elements of the recovery plans in the EU MSs yet. However, on the basis of the Online Platform on Sustainable and Resilient Recovery from COVID-19, policy areas and sectors for spending can be disentangled. The following table shows those EU countries for which information was provided. Most MSs have foreseen measures and activities related to the building sector, the transition to renewable energy, sustainable transportation and adaptation planning.

Adaptation planning refers to the process of adjustment to the impact of climate change, including action taken to reduce the negative impact of climate change, or to take advantage of emerging opportunities⁵. In this category, measures/actions related to the national climate adaptation strategies and/or plans are included, e.g.: a new, more ambitious EU strategy on adaptation to climate change (EC), development of reports on

¹ https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en.

² <https://www.ecologie.gouv.fr/france-reliance-transition-ecologique>.

³ <https://www.bloomberg.com/news/articles/2020-07-21/eu-approves-biggest-green-stimulus-in-history-with-572-billion-plan>.

⁴ based on IMF data, official government estimates and own sources.

⁵ <https://apt.pacificclimatechange.net/what-is-adaptation-planning>.

the implementation of adaptation measures (BG), introducing new funding programmes/financial instruments/subsidies (DE, LT, PL, RO), implementing overview of current action plans and/or updating/developing national/regional action or adaptation/recovery plans (CY, EE, EL, ES, FI, FR, PL, SI, SK), strategies/plans already developed (NL), establishment of local structures with responsibilities in climate actions (IE). Waste management and circular economy is also included in the recovery plans in a number of MSs.

Table 1. Measures and actions on climate change and environmental protection in the context of Covid-19 recovery

Measures and actions on climate change and environmental protection in the context of COVID-19 recovery*/EU Member States** and Norway	Categories																													
	Climate mitigation and adaptation measures														Cross cutting issues				Other environmental measures				International cooperation		Others					
	Building sector	Technological innovation (digitalization/hydrogen/CCUS***, etc.)	Transition to renewable energy	Household sector	Sustainable transportation	Industry sector	Land sector	Health	Human settlements	Water	Agriculture/Food security	Tourism	Infrastructure	Adaptation planning	Others	Urban/rural development (energy access)	Citizens' lives (behaviour)	Governance	Sustainable finance (public/private)/market mechanisms/carbon pricing	Others	Ecosystem services/biodiversity/land use/agriculture	Waste management and Circular economy/sustainable production and consumption	Other environmental pollution countermeasures	Others	COVID19 recovery and other environmental issues	Others	Inclusive action	Solidarity	Others	
EC	X	X	X		X	X				X				X	X	X			X		X	X	X	X			X			X
AT	X	X	X	X	X	X								X	X						X									
BG	X				X									X		X	X				X	X	X	X						
CY			X											X								X	X				X			
DE	X	X			X									X		X										X				
DK	X		X																							X				
EE	X	X			X									X			X					X				X		X		
EL	X				X	X								X	X			X				X					X			
ES	X		X			X	X	X	X	X				X	X	X					X	X		X	X					
FI			X		X	X	X							X	X			X		X		X	X							
FR	X	X	X		X	X			X	X	X		X	X			X	X		X	X	X	X		X		X	X	X	X
IE	X	X	X		X		X			X			X	X	X	X	X		X	X	X	X				X				
IT	X				X																	X								
LU	X		X		X		X											X	X							X				
LT	X		X	X	X	X								X	X							X					X			
LV															X	X								X						
NL														X	X		X	X	X							X				
NO		X			X										X											X				
PL			X		X					X				X									X							
RO	X	X		X	X		X	X						X	X								X		X					
SE			X		X									X			X	X							X					X
SI	X	X	X		X	X		X	X		X		X	X				X				X	X				X			
SK	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X				X	X	X							
* The information was extracted from the Online Platform on Sustainable and Resilient Recovery from COVID-19, launched on the occasion of the Online Ministerial Meeting, held on 3 September 2020, attended by high-level officials of United Nations Framework Convention on Climate Change (UNFCCC) Parties and non-state stakeholders - https://platform2020redesign.org/#about At the moment of developing the current report, the EU Member States were still in process of preparing their national recovery and resilience plans. **BE, CZ, HR, HU, MT and PT - no participation/measures presented on the Online Platform on Sustainable and Resilient Recovery from COVID-19; but they all have adopted national adaptation strategies - https://climate-adapt.eea.europa.eu/countries-regions/countries ***Carbon capture, utilisation and storage																														

Source: own elaboration on the basis of the Online Platform on Sustainable and Resilient Recovery from COVID-19.

The greening of the economies will have an impact on labour markets. Jobs will disappear or change content and new jobs will emerge. The magnitude of the impact and patterns of transition will vary between sectors and regions. There are high expectations on the management of the transition in terms of employment of skills. PES is a key actor in this process.

The objective of the small-scale study 'Greening of the labour market – impacts for the PES' is:

- to help PES identify relevant input to political processes to increase support of green skills measures – types of skills needed, financing, validation and certification etc.;
- to help identifying needs to co-operate with partners and stakeholders as well as other public authorities, the social partners and employers;
- to illustrate the scope and design of PES initiatives to identify transferable skills and to train/upskill jobseekers for green economy jobs, and adaptation of ALMPs to future needs;
- to help PES identify any need for revision of classifications and taxonomies.

1.2 Methodology

This study has been completed using research on green labour markets and skills for green jobs carried out by international organisations, such as the EC, including previous studies of the European Employment Observatory and the PES-to-PES dialogue, Cedefop, OECD and ILO, as well as by research undertaken in selected EU MSs. The current study draws on some recent studies from which implications for PES activities can be derived. Good practice of PES activities as well as an overview of challenges they perceive have been identified through web-based research, as well as through examples documented in other studies, including project reports from EU-funded activities.

In addition, 11 interviews have been conducted, of which seven with PES (France, Norway, Portugal, Romania, Spain, Slovenia, Poland region Silesia), two trade union organisations (ETUC – European Trade Union confederation and EFFAT – European Federation of Food, Agriculture and Tourism Trade Unions) as well as Eurochambers and Traxis Group, a member of SmartEn⁶. The interviewed PES represent different types of labour markets across Europe. These interviews help to deepen insights on PES challenges and measures. Examples from PES in other countries are taken into account based on literature review and web research. Overall, there is a wide geographical coverage of PES examples included.

2. DEFINING GREEN JOBS

2.1 Definition

There is no common definition of green jobs. According to a definition provided by ILO (2015)⁷ **green jobs** are 'jobs that reduce the environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable. This definition covers work in agriculture, industry, services and administration that contributes to preserving or restoring the quality of the environment while also meeting the criteria for decent work – adequate wages, safe conditions, workers' rights, social dialogue and social protection. It also covers activities related both to mitigation of and adaptation to climate change'.

⁶ The Spanish PES, Portuguese PES and Traxis Group provided written answers.

⁷ Based on a definition of ILO and UNEP in 2008, green jobs are defined 'as work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity, reduce energy, materials, and water consumption through high efficiency strategies, de-carbonize the economy, and minimize or altogether avoid generation of all forms of waste and pollution. https://unstats.un.org/unsd/envaccounting/londongroup/meeting18/LG18_28.pdf.

Also, green jobs are mentioned in different contexts, referring to notions such as green economy, low carbon economy, circular economy, greening transition, sustainable development, environmental sustainability. These concepts are not identical, although they are often used interchangeably. According to ILO (2018), the **green economy** is an 'economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities.' The **green transition** would describe the process through which an economy becomes a green economy, and thus by which economies reduce their reliance on greenhouse gas emissions (low carbon) and become resource efficient. The **circular economy** 'aims to maintain the value of products, materials and resources for as long as possible by returning them into the product cycle at the end of their use, while minimising the generation of waste', according to Eurostat⁸.

The boundaries of what activities and production processes can be included under the notion of green economy are becoming more and more blurred. It still needs to be clarified what to include in the measurement of a green and greening economy. This decision depends on what should be looked at in the first place and may be policy driven. Also, definitions and categorisation change over time. A Eurostat handbook providing definitions, data collection methods and **examples for the environmental goods and services sector (EGSS)** was published in 2009 and updated in 2016, now including activities in sectors such as the production of cars with zero emissions (Eurostat, 2009, Eurostat 2016).

Eurostat also measures employment in the **environmental economy**. One way is to measure relevant activities by sectors. The environmental economy can be analysed with a view on **production units, using the statistical classification of economic activities (NACE)**. Energy and water supply, sewerage and waste was the sector that had most full-time equivalent environmental jobs, followed by construction and services. This activity includes energetic refurbishment of existing buildings and the construction of new energy-efficient buildings as well as noise insulation work, maintenance and repair of water networks, construction work for wastewater and waste treatment plants and sewerage systems. Employment in the environmental economy can be broken down by environmental protection and resource management activities, following the classification of environmental protection activities (CEPA) and the classification of resource management activities (CReMA)⁹. For the PES, the challenge is that 'green jobs' and 'greening jobs' (or green skills and competences required in the changing profiles of occupations) are difficult to grasp since green jobs are to be found in all sectors and many occupational groups. The ILO definition may be found to be little operational for the PES (interview with Portuguese PES).

Green jobs are defined more or less broadly in those EU MSs, where identifying green jobs have been carried out, depending on the policy focus. In some cases, green jobs are identified in relation to a specific sector, defined as a 'green sector'. Others base their definition on activities across sectors. Another possibility is to look at the main content and objective of an occupation. A distinction between 'green' and 'greening' jobs is also made. In the following some examples are given:

- **Austria:** The Public Employment Service (AMS) has developed a specific tool for mid-term skills anticipation. This is part of the skills anticipation system in Austria in which also research institutes play a significant role. The **Skills Barometer**¹⁰ is

⁸ <https://ec.europa.eu/eurostat/web/circular-economy>, accessed 09 April 2021.

⁹ <https://ec.europa.eu/eurostat/statistics-explained/pdfscache/41606.pdf>.

¹⁰ The Skills barometer is run by the Austrian PES together with the consultancy firm, 3s Unternehmensberatung, the Austrian Federal Economic Chamber (WKO), the Institute for Research on Qualifications and Training of the Austrian Economy (IBW).

an online tool, which provides information on trends and medium forecasts and provides detailed occupational profiles related to jobs in demand in the labour market (Cedefop, 2017). For the identification of green jobs in the AMS qualification barometer, the definition of EUROSTAT has been used, whereby the environmental sector in Europe is recorded under the name '**Environmentally-oriented production and services**'¹¹. Despite the limitations mentioned, the empirical representations of green jobs in the qualification barometer are based on the environmental economy of EUROSTAT, which is applied at the national level by Statistics Austria¹².

- Examples for a sector approach include **Denmark**, where green employment is involved in the production of goods and services in order to either **protect the environment or save resources** (e.g., renewable resources, saving of energy and heat, handling of wastewater, and handling of other waste) (Cedefop, 2018 [Denmark]).
- In **France**, there is a **National Observatory for Jobs and Occupations of the Green Economy** (Onemev¹³) was created in 2010, bringing together a wide range of actors. Onemev identified **10 green occupations and about 52 greening occupations based on** the PES classification of occupations ROME¹⁴. The ministry of employment and the French PES are members of the observatory¹⁵. In accordance with Onemev, the French PES Pôle emploi provides the following definition of green and greening occupations on its website: (i) **green occupations** are those contributing to measuring, preventing, controlling and correcting negative impacts and damage to the environment (e.g. maintenance officer of natural areas, forest ranger, technician in charge of the water police, etc.); (ii) **greening occupations** include occupations whose finality is not environmental, but which integrate new 'skills building blocks' to take into account in a significant and quantifiable way the environmental dimension in the professional act (e.g.: architect, thermal insulation installer, logistics manager, gardener, etc.).
- In **Italy**, the Work Atlas (*Atlante Lavoro*) is a detailed map that describes the work in terms of activities, tasks, products and expected services by the National Institute for Public Policy Analysis INAPP¹⁶. It links the skills and competences acquired in education or training contexts, formal or otherwise, with the demands of the world of work. Through the information system of the Work Atlas, it was possible to identify all those economic activities that can be defined as **core green, that is, with work processes aimed at the production of goods and services directly connected to the environmental issue and which do not constitute**

¹¹ 'The environmental sector consists of a heterogeneous group of producers of goods, technologies and services, which extends across all economic sectors. Environmental products should avoid or at least reduce environmental damage, treat, measure and examine it. Resource depletion should largely be avoided or at least reduced, measured, controlled and examined through resource-efficient goods, technologies and services' (EUROSTAT 2009).

¹² <http://bis.ams.or.at/qualibarometer/hilfe.php?load=methodik4>, accessed 12 April 2020.

¹³ <https://www.ecologie.gouv.fr/observatoire-national-des-emplois-et-metiers-leconomie-verte>.

¹⁴ As the PES classification does not allow a quantification of jobs, these occupations were translated into the usual classification. This means that 9 green occupations and around 70 greening occupations –have been identified in the national classification system of occupations PCS, <https://www.notre-environnement.gouv.fr/site-ree/themes-ree/economie-verte/emplois/les-emplois/article/les-emplois-dans-les-metiers-de-l-economie-verte>.

¹⁵ Other members include: the statistical office, research institutes, continuous training agencies are, the alliance of municipalities.

¹⁶ <https://inapp.org/it/inapp-comunica/sala-stampa/comunicati-stampa/presentato-l%E2%80%99atlante-lavoro-una-mappa-universale-elaborata-dall%E2%80%99inapp>, accessed 12 April 2020.

alternatives to traditional production. Subsequently, the occupations operating in the core green activities could be disentangled by dividing them into: **full green**, i.e., new professions entirely due to the green economy (energy engineers, planners, landscape architects and specialists in the recovery and conservation of the territory, technicians of energy saving and renewable energies) and **hybrid**, that is, pre-existing skills to the green economy but up-to-date (materials engineers, marketing technicians, civil construction technicians). Alongside these there are the go green or professions potentially upgradeable with green skills (managers of companies operating in agriculture, fashion designers, travel agents) but where this step has not yet been completed.

- In **Germany**, a total of **31 occupational types** on the five-digit level of the classification of occupations have been identified as '**environmental occupations**' by the **German PES**, the Federal Agency for Labour (Bundesagentur für Arbeit). These occupations have been identified as directly contributing to environmental protection, resource conservation, sustainable use of nature, recycling or similar purposes; they exclude jobs – like marketing, trade, or IT – which are not substantially concerned with environmental regulation. Note, however, that other actors, e.g., universities, have introduced engineering and IT study courses that focus on sustainable development (Cedefop, 2018).
- In **Spain**, the **PES SEPE** (Servicio Público de Empleo Estatal) has conducted through its occupational observatory a prospective study on the impact of measures for a circular economy¹⁷ in 2020. It lists **over 50 occupations** according to national occupational classification code (CNO) and identifies new occupations (SEPE 2020). **Greening** mainly involves promoting environmental awareness; analysing product lifecycles and sustainability criteria; managing related technologies, regulations and legislation; managing resources; and recycling waste and reusing materials. It emphasises that involving industrial engineers, mining engineers (mainly for hazardous waste), design engineers, industrial organisation engineers and management analysts should be encouraged. Many businesses are expanding their environmental departments and need specialists such as geologists, chemists and chemical engineers, process engineers, biologists, environmental science graduates, environmental technicians and agronomists. The chemicals industry is important in Spain, and so it must be a major participant in the circular economy. It also affects quality control technicians, laboratory technicians and chemical plant operators, as well as mechanical and industrial technician occupations, and in a general way, many hospitality and tourism occupations and service occupations. This shows that a range of existing occupations will be in demand. In some cases, this may require additional skills. A new occupation has been identified such as the 'Circular Economy Manager' occupation. (Source: interview with the Spanish PES). The **Slovenian** PES has drawn up a report on green jobs in 2018 and identified 10 sectors with a potential for 'greening'.

Methods to identify green jobs

In **France**, the observatory for the measurement of jobs and skills of the green economy, set up by the ministry of the ecological transition in 2010, Onemev ('Observatoire national des emplois et métiers de l'économie verte'), has developed two approaches to monitoring

¹⁷ Estudio Prospectivo de las Actividades Económicas Relacionadas con la Economía Circular en España published on the SEPE website <https://www.sepe.es/HomeSepe/que-es-el-sepe/comunicacion-institucional/noticias/detalle-noticia.html?folder=/2020/Noviembre/&detalle=estudio-prospectivo-de-las-actividades-economicas-relacionadas-con-la-economia-circular-en-espana>.

employment: (i) **an activity-based approach**, which in particular highlights changes in 'eco-activities'; (ii) another approach based on **jobs and occupations**, making it possible to estimate the number of jobs in the so-called 'green' and 'greening' professions. Onemev departs from the definition established by Eurostat and the OECD and adds some activities: R&D, environmental engineering, and certain public services. Secondly, the approach includes what are called 'peripheral activities', contributing to a better environmental quality but less directly in the core of the green economy (Cedefop 2018). Other actors have also conducted research on green jobs and skills for green jobs, including the Agency for ecological transition (ADEME).

Onemev and ADEME prepare in-depth qualitative studies on occupations. The cooperation between various ministries and agencies and a wide range of other actors are characteristic for the French approach. Also, the Prime minister's office (France stratégie), brings key partners together for their skills forecast and foresight studies.

In **Spain**, skills needs are identified amongst others through consulting experts from the private sector, social partners, training and research centres¹⁸. This methodology has also been applied to identify green jobs and skills needs for green jobs, or more precisely jobs related to the circular economy.

The **US** Bureau of Labour Statistics has carried out significant work using O*Net to identify green occupations and stating whether these occupations require enhanced green skills, new and emerging green skills¹⁹. The US Bureau of Labour Statistics includes information on green jobs on its career outlook web page²⁰.

A similar approach was recently implemented at **EU level**, by the study on the labour market impact of the circular economy which used the European ESCO classification (Cambridge Econometrics et al. 2018). The **ESCO classification of Skills, Competences, Qualifications and Occupations**, available in full since 2017, has been developed by the European Commission over a number of years to set out job, skills and knowledge requirements at a highly granular level. Its occupational map provides an overview of the skills, competences and knowledge associated with key occupations for the sectors most impacted by circular economy take-up.

Helmrich (2014) analysed **registered vacancies** in **Germany** using the PES database. The job description of 700,000 vacancies was analysed by searching for 800 words relevant to the green economy. An assessment of the demand for green jobs are also provided by **private employment services**. To give an example, Morning Future, powered by the Adecco Group, has listed the 10 most demanded green jobs²¹.

¹⁸ In the Training Needs Survey and Detection Report, 2020, of the 449 experts consulted for the 2020 Report, 385 or 64.37% of the informants came from private companies; 6.01% from sectoral business organisations or associations (including Chambers of Commerce, CEOE (National Business Confederation), CEPYME (National SMEs Confederation), provincial and regional employers' federations, Construction Labour Foundation); 4.42% were from trade union organisations (UGT, CCOO, CIG, SAE, Asaja). In total, these three groups of experts represent 74.80% of the informants consulted. The rest were from other types of bodies: 11.80% from training and research centres, 5.12% to staff working in government bodies, and the remaining 8.24% to professional associations, foundations or other types of associations and entities operating in the labour market.

¹⁹ https://www.bls.gov/careeroutlook/subject/green_jobs.htm.

²⁰ https://www.bls.gov/careeroutlook/subject/green_jobs.htm, accessed 9 April 2020.

²¹ These are: the sustainable cook; high efficiency electrical network installer; green mechatronic; low environmental impact A/C system installer; energy management expert (energy engineer); sustainable materials construction consultant; environmental industrial mechanic; environmental lawyer; environmental IT tech; specialist in green consulting; <https://www.morningfuture.com/en/article/2020/01/24/2020-green-jobs-most-in-demand/833/>.

2.2 Conclusions for PES

What is decisive for the PES is to grasp the structural changes associated with a transition towards a green economy, which has to be seen in a broader way than looking at the environmental sector only or at the circular economy. For the PES, the definition of green occupations and greening occupations is decisive for improving placement activities into jobs demanded by a greening economy as well as improving training/retraining programmes, better planning these programmes in line with new requirements of the green transition, as well as for providing relevant information for career advice and vocational guidance services.

As shown above, some PES have started to identify occupational profiles for green jobs and have linked vocational guidance and information on occupations. In **France**, information on identified green occupations with the occupational classification of PES (ROME) as well as links to related vacancies is published on the web²². The French PES distinguishes between 'green occupations' and 'greening occupations'. Pôle emploi has identified the priority and strategic professional sectors affected by the green economy: mainly agriculture, forestry, fisheries, energy, resource-intensive manufacturing, recycling, construction, transport, etc.²³. The French PES also links on its website to other studies and occupational profiles for green jobs established by other stakeholders, namely of the ministry for ecological transition.

In **Germany**, information on occupational profiles and skills requirements as well as educational training, including from identified green occupations is available at BERUFE.NET. This is an online career advice portal of the Federal employment agency that contains information on future trends in several individual occupations. It uses labour market information from different sources (research institutes, federal offices and ministries, chambers, associations). This database includes green jobs. In **Spain**, the results of the occupational observatory are regularly published as a PDF. In **Austria**, the output of the Skills Barometer is aimed at young people, careers counsellors, PES advisers, educational institutions, employers, jobseekers, and policymakers. Skills forecasting consists of a short- and medium-term perspective on the demand for skills in the labour market (using occupation as a proxy measure for skills) (Cedefop, 2017).

In the case of **Portugal**, a **working group** is being created that includes experts from Portuguese PES (ANEQP – National Agency for Qualifications and Professional Education) and the General Directorate of Energy and Geology to update the training references of the National Catalogue of Qualifications and the creation of new references in the area of green jobs²⁴.

²² <https://www.pole-emploi.fr/actualites/le-dossier/environnement/les-emplois-de-leconomie-verte-1/les-metiers-verts.html>.

²³ The green economy includes: economic activities oriented towards the environment (water treatment, recycling and recovery of waste, renewable energies) traditional economic activities which take into account the environmental dimension (agriculture, transport, construction, industry, etc.), <https://www.pole-emploi.fr/actualites/le-dossier/environnement/les-emplois-de-leconomie-verte-1/leconomie-verte--definition.html>.

²⁴ Source: interview.

3. GREENING LABOUR MARKETS

3.1 State of play: assessing volume of green jobs

Employment in green jobs - selected results

As there is no common definition of green jobs and the green economy, and as there are different approaches to measuring them, with all their limitations, it is not possible to provide a complete picture of employment patterns in the green economy. The following table gives an overview of employment share in some sub-sectors or cross-sector concepts that are part of the green economy, as well as in green and greening jobs when these have been identified.

Table 2. Employment in the green economy, green jobs and greening jobs

EU / EU-MS	Sectors / activities	Employment in % of total employment	Date	Source, comments
EU-28	Bioeconomy	8.6% (17.5 M)	2017	European Commission
EU-27	Environmental economy	4.2 M full-time equivalents	2020	Eurostat**
EU-28	Circular economy	1,8% (4 M) Employment growth of 5% between 2012 and 2018.	2018	Cambridge Econometrics et al (2018) for the European Commission
Spain	Circular economy	3.1%	2018 (Q4)	SEPE occupational observatory (2020)
Germany	Environmental protection	5% of the labour force	2012	Federal Agency of the Environment
France	Green economy	0.5% green jobs 14% greening jobs	2017	Statistical office Insee
Italy	Full green and hybrid green jobs in the economy	Full green and hybrid jobs by sectors: Public utilities: 30%, 7.5% Construction: 2%, 44.8% Manufacturing: 0.8%, 9.1% Extractive industries: 0.4%, 7.6% Agriculture: 0.1%, 3% Social services: 0.1%, 10.5%		INAPP Large variations between sectors.

(*) Energy-intensive industries include the sectors iron and steel, minerals, refineries and chemical industries.

(**) In 2017, among the employment in the environmental economy in the EU-27, the largest shares of employment were in the area of management of energy resources, followed by waste management, wastewater management, and other environmental protection. The share of employed in management of waters was very low.

Sources : https://knowledge4policy.ec.europa.eu/bioeconomy_en, <https://www.notre-environnement.gouv.fr/site-ree/themes-ree/economie-verte/emplois/les-emplois/article/les-emplois-dans-les-metiers-de-l-economie-verte>, <https://ec.europa.eu/eurostat/statistics-explained/pdfscache/41606.pdf>; Edler et al., 2018.

As addressed in section 2, there are limitations in measuring 'green' and 'greening' or 'hybrid green' jobs. For example, in France, the statistics presented in overviews of employment in the green economy are subject to classifications (PES classification ROME, national occupational classification PCS) which, despite changes, may not take into account all of the recent changes in jobs related to the environment. The list of jobs in the green economy is therefore not exhaustive, and the corresponding number of 'green' jobs is certainly underestimated. Regarding greening professions, the actual greening affects only some of the professionals. In the absence of being able to estimate this share, all of the workforce in the same profession is taken into account for the sake of calculations, with

the exception of agricultural production professions which were not included in the list of green professions. The number of 'greening' jobs corresponding to green professions is therefore overestimated²⁵.

Employment by gender

Men are more often employed than women in 'green jobs', 'greening jobs' or jobs in the 'green economy'. In **France**, for example, in 2017, women represented only 18% of both green and greening jobs (a slight increase since 2008, Cedefop, 2018 [France]). The share of women among all employed in the French economy was 48% in 2017. A gender segregation across occupations can be observed. Although women were on average under-represented in green and greening occupations, they were largely overrepresented among greening occupations in tourism (with a female employment share of 72%), retail trade (55%) and industrial design (52%), and only slightly below the national average in the area of greening public research occupations (42%) and the green occupational group of environmental engineers and professionals (40%). The share of women rises as occupations become more skilled²⁶. Likewise in **Spain**, the prospective study on the circular economy SEPE (2020) has shown that only approximately a sixth of all of those employed in the circular economy were women (4th trimester 2018). Also in **Estonia**, it has been acknowledged that women are under-represented in the relevant sectors. The Estonian Gender Equality and Equal Treatment Commissioner has pointed to the greater skills necessary for the green economy and bio-economy jobs (Cedefop, 2018 [Estonia]).

The International Renewable Energy Agency (IRENA, 2019) finds that the share of women in employment (32%) is higher in the renewable energy sector than in conventional energy. Indeed, in **Germany** for example, the share of women graduates in engineering and informatics is significantly higher if these lead to a specialisation in environmental engineering and IT as compared to engineers and IT experts for conventional industrial activities (ILO, 2020). Nevertheless, gender inequalities in acquiring skills for green and greening jobs persist.

In addition to gender inequalities in the choice of study fields and occupational segregation, other employment barriers for women may be relevant in specific sectors and regions. For example, it has been pointed out that in some parts of Europe the agricultural workforce is experiencing further 'masculinisation' as a result of insufficient training infrastructure and appropriate childcare facilities (ICF, 2012). In order to increase the share of women in green jobs, PES can provide vocational guidance, and can support women to take up related STEM study fields and jobs. In the local context PES can advocate for an adequate supply of childcare facilities.

Employment by age groups

The few available data and studies indicate that 'green jobs' may often be taken up by young people and young adults. This may be related to the fact that a number of the low-skilled jobs are physically demanding, and those requiring a higher level of skills may require emerging specialisations. Conversely, employment in sectors affected by the green transition is often characterised by a higher share of mid-aged or older workers (e.g., mining).

²⁵ <https://www.notre-environnement.gouv.fr/site-ree/themes-ree/economie-verte/emplois/les-emplois/article/les-emplois-dans-les-metiers-de-l-economie-verte>.

²⁶ <https://www.notre-environnement.gouv.fr/site-ree/themes-ree/economie-verte/emplois/les-emplois/article/les-emplois-dans-les-metiers-de-l-economie-verte>.

In **Spain**, most of those employed in activities related to the circular economy are young people or young adults (SEPE, 2020). According to 2017 data, around 15% of young people in **Poland** find their first employment in the green jobs sector (jobs in the protected areas) (Sulich et al., 2020).

3.2 Assessing the impact of ‘green deal’ type of policies on the labour market

While there are differences in the estimated impact on employment in specific sectors, available studies carry two main messages: (i) net employment effects are likely to be slightly positive, or roughly neutral, (ii) however, shifts across sectors and occupations will be sizeable.

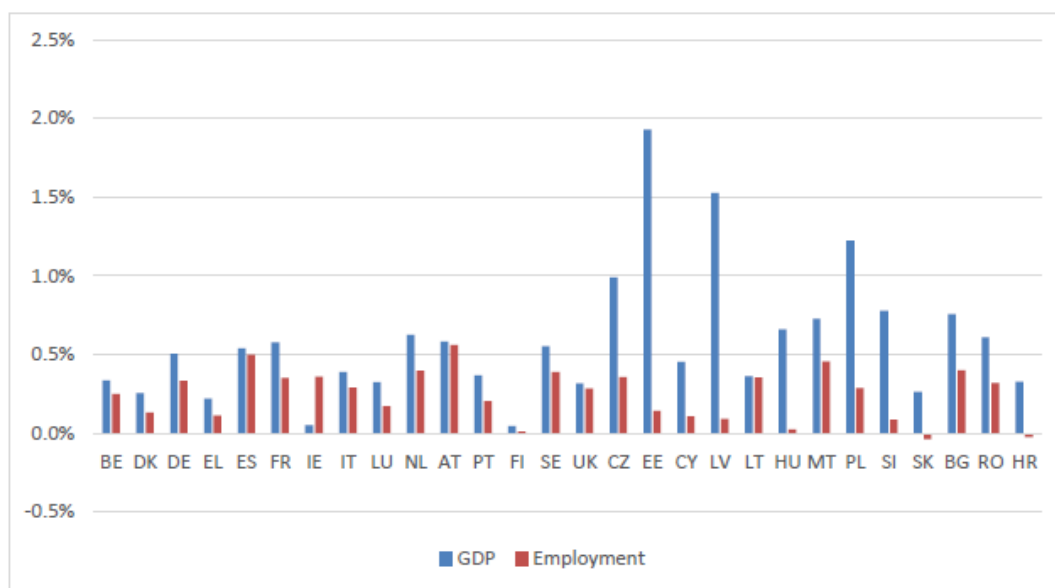
UNEP has analysed in 2011 the economic impact of the transition to a **lower carbon economy**. It has modelled two scenarios with different levels of investment over the period 2010-2050. In both scenarios there will be a positive effect on GDP of a transition towards a low-carbon economy as compared to a business-as-usual scenario. The employment impacts are neutral in these scenarios, but these are net results, and therefore account for job losses as well as gains (OECD, 2017a).

Meanwhile some projections have included macroeconomic effects. The European Commission has estimated the long-term labour market impact of a transition towards **climate neutrality**, with two scenarios (European Commission, 2020). The baseline scenario is designed to implement the legally binding policies the EU and its MSs had adopted by the end of 2014²⁷, assuming that those will be implemented until 2030. The more ambitious climate neutrality scenario is designed to achieve net zero greenhouse gas emissions by 2050. Employment effects of the more ambitious scenario would be positive in the long-term (net gain of 1.3 million jobs as compared with the baseline scenario by 2050). The main labour market effect would be a structural shift in employment across sectors.

According to **European Commission** estimates, based on projections prepared by Cambridge Econometrics et al (2018), the **ambitious circular economy** scenario will have net positive benefits in terms of GDP growth (additional 0.5% by 2030) and job creation (+ 700 000). According to this study, employment growth is driven by additional labour demand from recycling plants, repair services and rebounds in consumer demand from savings generated through collaborative actions. Employment growth would mainly take place in the waste management sector, repair and installations and service sector, while large employment losses would be expected in the construction sector, linked to efficiency gains. The following figure presents results for the ambitious circular economy scenario by MSs and shows the percentage difference in GDP and in employment. The variation in the employment results among MSs reflects the different economic structures and labour intensities of the main circular economy activities across the EU. While on average MSs are projected to have small employment gains, a few countries will have small net employment losses, including the Slovak Republic and Croatia. Forecast net employment gains are very small for Hungary and Finland, while all other EU MSs would see sizeable employment growth.

²⁷ This refers to the objective to reduce greenhouse gas emissions (GHG) to contain global warming to well below 2°C until the end of the century while pursuing efforts to limit it to 1.5°C and Nationally Determined Contributions (NDC) to achieve this goal.

Figure 1 Employment and GDP results of an ambitious circular economy scenario, in % from the base scenario by 2030



Source: Cambridge Econometrics et al., 2018.

These findings are confirmed by the **ILO** (2018) estimates of employment effects of a **circular economy scenario** globally and shows results for Europe.

The ILO (2019 and 2018)²⁸ has conducted a forecast of the employment effect and skills implication of a **sustainable energy and a circular economy scenario**, based on 32 country surveys and case studies carried out worldwide (including six European countries analysed by Cedefop 2018). In both the energy sustainability and the circular economy scenario, net employment effects are assessed to be small, but there will be high numbers of jobs destroyed and created.

Simulations using the OECD computable general equilibrium model, ENV-Linkage (Chateau et al., 2014, OECD 2017b) considers the employment effect and sectoral shift of a global 'mitigation-only' policy scenario to limit global warming to 2°C. The simulation finds sectoral reallocation effects to be modest in terms of overall employment. However, impacts are found to be significant for some sectors.

The **German** research institute on employment of the Public Employment Service, the IAB, has carried out a forecast of the effects of the German government's **climate package**²⁹ and has compared GDP and labour market outcomes to their baseline scenario of skills forecast QuBE (carried out for the Germany Ministry of Labour) (Mönning et al., 2020). The main outcome is that as a result of growth inhibiting effects and growth promoting effects, real GDP will be at a lower level in the long term (2035) as compared to the baseline scenario. Nevertheless, employment would be positively impacted, as the labour-intensive construction industry would benefit in particular from the packages. A study carried out by Lehr et al (2019) on behalf of the Federal Agency for the Environment in Germany, confirms the expectation of positive net employment effects, driven by advances in technology and employment effects in the construction industry and services.

²⁸ https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_7322_14.pdf.

²⁹ As of 20.09.2019 plus the change from the Federal-Länder compromise of 16.12.2019.

There have been few evaluations conducted on the employment impact of '**greening economy**' components **of previous stimulus packages** (Agawala et al, 2020). Popp et al (2020) conducted a study on the employment impact of the green stimulus under the **US stimulus package ARRA in 2009**. The results of this evaluation are relevant for the EU, as at that time the US was spending a higher share of its recovery plan on promoting the greening of the economy. Green investments, which constituted approximately 17% of all direct government spending in ARRA, included spending on renewable energy, public transport and clean vehicles, energy efficiency, building retrofitting, and modernising the electrical grid. A main outcome of this evaluation was that employment effects were positive in the medium and long-term (mainly during 2013-2017). Another important finding was that the ARRA green stimulus appeared to be most effective in communities which had workers who already possessed the skills required for green jobs. These skills are mostly technical and engineering skills needed to operate, maintain and develop green technologies. They find that in such communities, ARRA created jobs in both the short and the long run, where nearly all of the new jobs were manual labour positions.

3.3 Conclusions for PES

The net employment effects of the different policy fields and areas for greening the economy, taken together, show a low positive net employment effect in the future. However, the volumes of job destruction and job creation are assumed to be significant, at least for some sectors. The challenge for labour market policies will consist in making sure the transition between sectors and occupations works as smoothly as possible. There is a risk that unemployment increases while labour shortages and skills gaps may pose a problem for implementing the greening of the economy.

To facilitate the green transition and to minimise any potential future skills mismatch it is necessary to get an idea of which skills and competences may become obsolete, and for which categories or workers, and on the contrary which type of skills and tasks will be more in demand. This requires analysis and foresight of the current and future impact of a move towards greening the economy. As the impact may vary quite significantly between regions and local areas, PES would need to have a close look at the local and regional economic structure, and the potential impact of policies on specific territories, sectors or labour market segments. Thus, the move towards greening labour markets calls for increased labour market observation and analysis activities, and thus raises expectations of labour market information systems. Also gathering the assessments of a wide range of stakeholders on the labour market impact of a transition towards a greener economy.

4. IMPACT ON SKILLS

4.1 Overview

Introduction

It is important to understand what the impact of greening jobs has on skills in demand and skills mismatch in order to manage the transformation of those labour markets linked to the greening of the economy.

Basically, skills policies, geared at reducing skills mismatch and skills gaps, need to disentangle:

- the growth of occupations requiring skills adaptation. Here a differentiation needs to be made between a low need for adaptation of skills within existing occupations, and a greater need for skills adaptation to render these occupations 'greener'. As shown in section 3, the volume of 'greening jobs' is much larger than the number of 'green jobs';
- the emergence of new occupations;
- the growth of green occupations and specific skills related to these occupations;
- a decline in occupations and skills not in demand.

In addition to skills adaptation through the inclusion of new skills into existing skills, the transferability and portability of skills from one occupation to another needs to be explored. These skills can be specific technical skills as well as generic (or so-called 'soft') skills. Therefore, this section looks into the impact of greening the economy and greening jobs on skills.

State of play

The different studies relating to the green economy, or specific aspects of the green economy allow us to get an overview of the skills profile of workers in green jobs and greening jobs. The results can, however, not be directly compared, as they are based on different definitions and data sources. Nevertheless, some examples provide some insights.

Table 3. Green jobs by skill levels in France, Spain and Germany

Country	Dimension of greening	Skills level	Year	Source
France	Green economy	Low-skilled in green jobs: 14% High-skilled in green jobs*: 20%	2017	Insee (website)
Spain	Circular economy	30% low-skilled 20% VET degree, 31% secondary general education and 11% upper secondary education 7% with a university degree	2018	SEPE (2020)
Germany	Greening the economy	New hires in sectors that have been identified as having a higher share of vacancies for green or greening jobs, show the following structure: 14% of low-skilled (increasing), 59% VET trained (decreasing), 27% of high-skilled (increasing)	2013	Helmrich et al. / Federal Agency for the Environment (2014)

(*) As defined of university entry qualification and at least an additional 3 years of education.

Source: own elaboration.

The estimated skills structure of employment in the green economies in Spain follows general employment patterns in Spain, with a significantly higher share of low-skilled as compared to France and Germany.

In France, the employment structure in green and greening jobs shows a higher share of low-skilled jobs as compared to the national average and a lower share of high-skilled jobs. The share of lower-educated employees was highest among occupations in water and waste management (38%), while the share of highly skilled employees was highest (46%) in occupations in environmental protection. Occupations in the production and distribution of energy and water mainly required a medium skill level³⁰.

The contrary can be observed in Germany. Measured by new hires, the share of low-skilled employees in sectors that have seen an increase in 'green' content of job vacancies is largely below the corresponding share in the other sectors (15% and 23% respectively), while the share of high-skilled jobs is significantly higher (27% and 13% respectively)³¹.

The need for skills has to be identified, and can follow different methodologies, for example through surveying employers as well as through qualitative studies. Qualitative studies are mostly based on consultations with employers and experts in the relevant fields who understand the changing nature, and skills requirements, of particular occupations. Because of the qualitative nature of these studies, they do not normally refer to the number of skilled people needed for a given number of jobs, but rather focus on the type of knowledge and skills required to perform the job in question, and any other qualitative aspects (ICF, 2012).

Few studies depart from the classification of occupations. ESCO allows for identifying knowledge and competences of over 3 000 occupations³². Cambridge Econometrics et al., (2018) carried out a profiling of 'key' occupations in terms of required skills based on the ESCO database at a detailed occupational level (up to four-digit level), by mapping the required skills, knowledge and competence associated with detailed occupations in the ESCO classification and combining this with the qualitative evidence about the impact of a more circular economy on jobs. This also allows us to analyse how similar profiles of skills are distributed across the economy, combined with qualitative analysis on skills required from a basis for judging the potential for cross-sector redeployment. However, there are limitations to using existing qualification classifications as they do not allow us to identify skills for new occupations, and as they may not be updated in a timely fashion.

Key findings from forecasts and foresight studies – an overview

ILO (2019) has assessed the employment effect and skills implication of a **sustainable energy and a circular economy scenario**, based on 32 country surveys and case studies carried out worldwide (including six European countries based on Cedefop, 2018), as mentioned above in section 3.2. The biggest impact would be on medium-skill level occupations. More than two thirds of workers who would lose their jobs would be reallocated in jobs in the same occupation in another industry. The study concludes that **men in mid-skill occupations will have the greatest need of reskilling and upskilling**. Although, there is a set of core, in particular soft skills, and technical occupations that is potentially transferable from one sector to the other, though retraining might be necessary to fit into the new job.

³⁰ Insee data, <https://www.notre-environnement.gouv.fr/site-ree/themes-ree/economie-verte/emplois/les-emplois/article/les-emplois-dans-les-metiers-de-l-economie-verte>, accessed 13 April 2021.

³¹ Note that the applied method only allows rough estimates.

³² <https://ec.europa.eu/esco/portal/home?resetLanguage=true&newLanguage=en>.

A particular challenge is related to potential employment losses for low-educated workers, although the circular economy would also create jobs for low-skilled workers. The demand for low-skilled workers in the construction industry, for example, may increase, while the green transition in the energy sectors will most likely increase the demand for high-skilled workers. Generally, the **transition towards a circular economy will require more high-skilled** workers, because of the new technologies that will be applied (interview ETUC).

Greenpeace in Spain has proposed 117 measures to address climate change in 2021-2024, which have been included in the document 'Turn the system inside out'. The implementation of 'Turn the system inside out' would increase demand for employment in the construction sector or in the agriculture and livestock sector, sectors in which there is demand for employment also of medium and low qualification workers.

However, reskilling will be necessary for transferring workers between these sectors. According to estimations by the authors, around 50% of the employment created by investments aimed at mitigating climate change (renewable energies, energy efficiency, carbon sinks, construction of new infrastructures in the transport sector), are low-skilled jobs in the case of Spain. The new jobs include service workers, skilled agricultural workers and elementary occupations. And around 30% additional, intermediate-skilled employment, mainly in the occupations of skilled industry and construction workers, facility operators, machinery and assemblers. 16% of new jobs in Spain would be for jobs requiring a high skill level (Greenpeace, 2020).

The prospective study for a circular economy conducted by the occupational observatory of the **Spanish PES has identified occupations for which demand will grow** in the context of the **circular economy (see annex)**. These occupations can be mainly found among directors and managers (group 1), scientific and technical staff (group 2), technicians and support staff (group 3), craftsmen and skilled workers in manufacturing industries (group 7), plant and machinery operators and assemblers (group 8), elementary occupations (group 9) (see Annex B1 for details). If considering the type of skills in demand, the **Spanish PES assumes that the required skill level will rise considerably, in particular since IT skills** play an increasing role, including at the level of technicians and university graduates (SEPE, 2020).

In **Portugal**, the PES perceives a major transformation of the labour market if technological development, and in particular artificial intelligence (AI) are considered at the same time. The 'green' revolution and artificial intelligence combined can bring about a reality with negative consequences in terms of available employment (interview Portuguese PES). For the PES the expected transitions will have to be accompanied by reskilling and upskilling. The linkage between greening and digitalization has also been stressed EU-wide (Ecera, 2020).

4.2 Impact on skills needs for occupations in selected sectors

With a view to the green transition, the required skill level for green occupations depends largely on the sector and type of activity. In the following section key challenges and estimated trends for skill requirements by sectors and selected occupations are looked at.

Overall, there seems to be a consensus across different forecasting studies that a circular economy scenario, a climate neutral policy scenario or other relevant scenarios have a small positive net effect on employment, with significant transition processes at the labour market. However, different scenarios, assumptions on policy measures and macro-economic models or other assessment methods, come to diverging estimates regarding employment and skills impacts in specific sectors.

According to the OECD, the ten most carbon-intensive industries in the EU-25³³ account for 90% of all CO₂ emissions, but for only 14% of total employment across all economic sectors. These industries include electricity, gas and water supply, water transport, air transport, petroleum and coal products, land transport, other non-metallic mineral products, basic metals, agriculture, fishing, food, chemicals and chemical products, mining and quarrying. The volume of job losses from reducing dirty economic activity will therefore be very modest in these industries (OECD, 2017). In the EU-27 there are 3.1 million jobs in energy-intensive industries³⁴ (Bruyn et al., 2020).

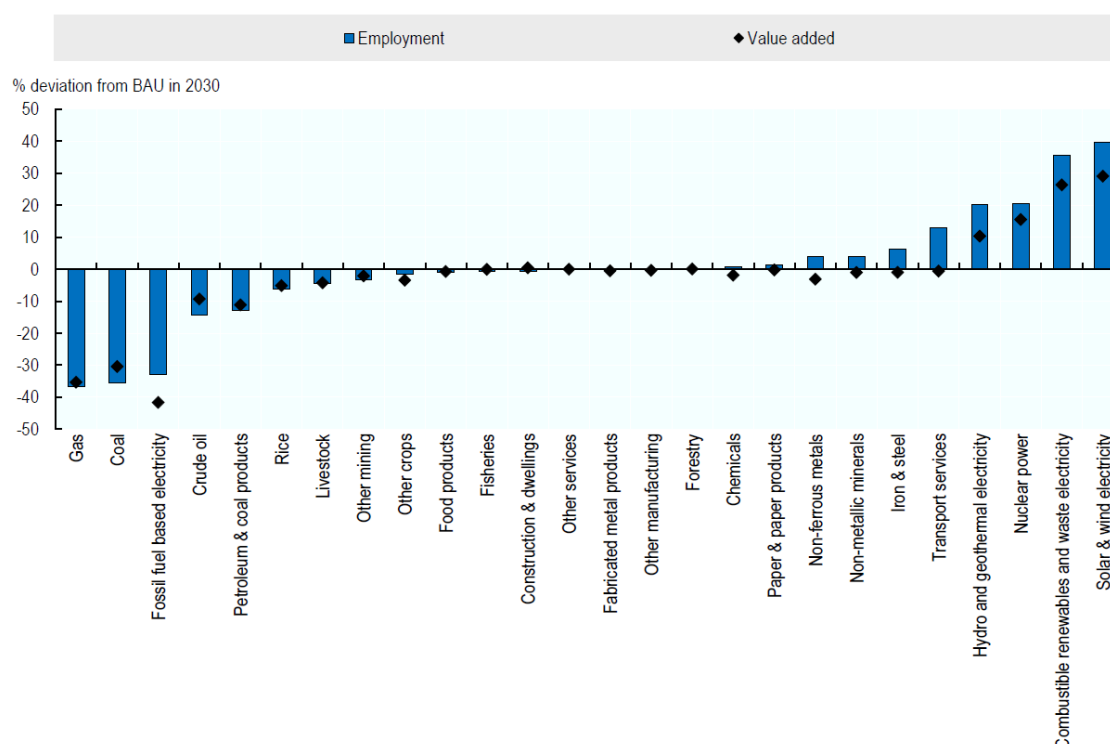
Nevertheless, direct and indirect employment reduction may be significant in specific regions. Net employment losses in energy-intensive industries induced through green policies are significant. Net employment losses among medium and high skilled employees in these industries are similar or much lower than the losses among the low-skilled.

The OECD (2017) has identified the following sectors with the potential to create green jobs: green agriculture, sustainable forestry, renewable energy, clean industry, sustainable construction, public transport, recycling and waste management and government activities. Some of these sectors, or specific sub-sectors, will be looked at in the following pages. In addition, the automotive industry, food and drinks industry and tourism will be briefly looked at in the following sections, as these sectors are also likely to be impacted by 'greening' policy measures and to shape the economic landscape in specific regions. While a sectoral approach to skills requirements may be justified, it should be kept in mind that some occupations are relevant in all sectors (e.g., IT specialists specialised in environment and energy).

The following figure gives an overview of the effect of GHG mitigation policies across sectors.

³³ EU countries that are members of the OECD.

³⁴ Energy-intensive industries include the sectors iron and steel, minerals, refineries and chemical industries.

Figure 2. The net job effects of GHG mitigation policies differ across sectors

Source: OECD 2017 Employment implications of green Growth.

Agriculture and forestry

The employment potential in Europe of sustainable agriculture has been projected by the ILO (2018), and net employment gains are expected for 2030. The share of employment in agriculture varies widely across EU MSs (22.8% in Romania and 2.1% in the Netherlands in 2017 and 2018 respectively, as compared to 4.1% on EU average)³⁵.

There are diverging trends as regards employment potential by skill levels. This is confirmed by the view of EFFAT (the European level confederation of workers in the food, agricultural and tourism sectors). A strategy for agroecology and organic farming would have great potential for creating new jobs, as production would be more labour intensive (interview with EFFAT)³⁶. A study on the impact of agro-environmental measures in Slovenia shows that these have played a significant role in the rural development programme (2007-2014). These measures have increased employment in large field crop and dairy farms (Unay Gailhard and Bojnec, 2018).

Digitalisation will transform labour markets in the sector. While agriculture is already digitalised in the northern European countries, this is not the case in southern European countries. It is perceived that digitalisation and automation may destroy mainly low-skilled jobs in the sector, while new jobs will emerge for IT-specialists and data analysts (interview with EFFAT). Thus, the impact on employment would also depend on adoption of new technologies and production processes.

³⁵ Eurostat, Agriculture, forestry and fishery statistics, 2019 editions.

³⁶ It has been estimated that organic farming creates 21% more jobs than conventional production in the US and 32% more in the UK and Ireland (OECD, 2017).

The greening of the sector through moving to a sustainable way of production will require upskilling and reskilling to get the required **mechanical skills and agroecology skills**. This is perceived as an area where PES support would be highly relevant. Examples for new and changing occupational profiles included at medium skill level are the adoption of organic farming techniques, and increased demand for agricultural technicians involved in crop diversification and application of improved technologies (ILO, 2019). Nevertheless, net employment is expected to be significant for low skilled workers. Net employment effects are also expected at high skill level but at a lower magnitude (OECD, 2017). It can be supposed that employment effects by skill levels vary considerably by region and type of agricultural production.

Other sectors such as **biofuels will require new skills (with a mix of agriculture and chemical skills)**. The bio economy is regarded as providing a significant potential for new jobs requiring new skills (interview EFFAT).

At high skill level, examples for changing or new occupations include e.g., soil and water conservationists, environmental restoration planner, environmental certification specialist, environmental economists, water resources specialists and water/waste engineers, agricultural meteorologists (ILO, 2019).

Automotive industry

According to the European trade union federation IndustriAll, out of the 2.4 million employees in the automotive industry, some 600 000 jobs are in producing conventional parts and components. These jobs will be at risk during the journey towards electro mobility. On the basis of an extrapolation to the European level of the study made by the Fraunhofer Institute for Germany, the trade unions expect at European level that the new CO₂ standards for passenger cars, recently voted in the European Parliament (-37.5% CO₂ reductions by 2030) will affect **108 000 direct jobs in the automotive industry in the EU** (IndustriAll).

A forecast and skills anticipation study for **Germany** that includes an **electro mobility** scenario, assesses the impact of electro mobility on employment (Mönning et al 2020)³⁷. Overall, the net employment effect of this scenario is negative with significant **employment losses for the automotive industry** until 2035 (83 000 workers). The study also finds that employment effects may vary over time. Employment is likely to rise in the short-term and fall thereafter. Positive employment effects in other sectors are indirectly related to the investment needs of the automotive industry. **Occupations in the area of mechanical engineering across sectors, and information and communications technology will benefit**. The energy suppliers will benefit from the switch to electricity as a means of propulsion and will be able to create new jobs. In view of infrastructure provision, the construction industry will at times also record additional hires. All skill levels will be more in demand in the short term. The **long-term decline** in employment is estimated to mainly affect **machine and vehicle engineering professions** and the professions for **technical development and construction of production controls**. Medium and long-term decline in the employment of experts and specialists can be attributed to the less complex structure of the electrified drive train in motor vehicles.

A survey conducted by Cap Gemini of automotive executives (N=503) and sustainability experts (N=317) in November-December 2019 shows that most automotive organizations

³⁷ Mönning, Anke; Wolter, Marc Ingo: TINFORGE – Trade in INFORGE. Methoden-Update 2020. In: GWS Discussion Paper 2020/4, Osnabrück 2020 – URL: <http://www.gws-os.com/discussionpapers/gws-paper20-4.pdf> (Stand 27.08.2020).

focus their activities to date on **recycling and incentivising the use of refurbished components and end-of life use of vehicles**. Sustainable development measures often use new technologies. One example is additive manufacturing or 3D printing technologies which help in reducing waste. Another example is the use of artificial intelligence (AI) (Cap Gemini, 2019). This also shows the need for IT specialists in this industry.

In general, the transition from mechanical technologies to low-carbon technologies such as **software development, big data analytics, emission control, and power electronics** will substantially transform the occupational profiles needed. New skills will be required through the use of the digital technologies. **New skills and experience** will also be needed in the areas of **electronics, electrochemistry and new materials**. Equipping the workforce with these new skillsets will become an important challenge for the automotive industry (IndustriAll). Note that greening the automotive sector may have different employment effects and skills impact, as the functions in the production process and skill levels and profiles follow a logic of division of labour (e.g., with R&D and mass production taking place in different countries) (see Annex Figure A2).

Construction

Most studies are expecting job creation in the construction sector (ILO, 2018). It is expected that greening the economy will mainly require skills to be added to and/or adapted by existing occupations. Nevertheless, some occupations will experience changes in their occupational profile. This would affect at the medium skill level e.g., carpenters, plumbers, electricians, heating engineers, roofers, painters, plasterers and building services technicians. At the high skill level, the occupational profiles of facility managers, architects, engineers, energy auditors and energy consultants may change (ILO, 2019).

The OECD expects net employment gains mainly for low-skilled workers in the construction industry as a result of ambitious green policies (OECD, 2017). Cambridge econometrics et al (2018) forecast a growth in specialist higher-skills occupations that replaces some lower-skills and trades-related roles as a result of a move towards a circular economy (Cambridge Econometrics et al., 2018).

There are arguments that more polyvalent skills will be needed for smart homes, as well as a hybridisation of skills (with IT becoming a transversal skills). New occupational profiles or key skills may need to be developed to implement smart homes in a holistic way, taking consumer needs into account, so there would be a need to develop a cadre for smart home technicians, with a generalist's rather than a specialist's profile, with sufficient knowledge in IT, management, electrics and heating) (interview with Traxis Group).

Energy sector

Fossil energy industries will see employment decline in a 'greening the economy' scenario. This includes the coal industry and the oil industry in particular. In contrast, employment is expected to grow in the area of renewable energy.

Expected employment losses in the area of energy supply and mining as a whole will mainly affect low-skilled workers, high-skilled workers and to a lesser extent medium-skilled workers (in descending order). These employment losses are significant and cannot be offset through employment creation in all three skills categories. Net employment losses will be largest for the low-skilled (OECD, 2017).

In **Norway**, employment in the oil and gas sectors are expected to decline. High-skilled workers in petroleum industry will need to adapt their skills so as to work in other industries (e.g., renewable energy or other sectors). Technological development, like automation and

digitalisation (which are also highly relevant for the ecological transition) will engender increased demand for high-skilled workers. Lacking new demand for low-skilled workers will represent one of the major challenges for the PES since green transition will take some time. Unemployment is therefore expected to rise in some periods (interview with the NAV, the Norwegian PES).

New occupations and skills are expected to emerge in the **renewable energy sectors**. New occupations at medium skill level emerge for example for photovoltaic/wind turbine/biomass systems requiring installers, technicians, plant manager and quality engineers. Ventilation and air conditioning technicians would need to acquire new skills. At the high-skill level, new skills will be required for engineers and system designers (ILO, 2019).

Food and drinks industry

The food industry is already characterised by a higher share of high-skilled workers compared to the agricultural sector. It can be expected that the **food sector will require more skilled/high-skilled workers for the green transition**. Transition of workers from the chemical industry to the food industry is common. These workers bring a relevant skill set with them. As the chemical industry is undergoing restructuring, occupational mobility between these two sectors may become even more relevant in the future. The PES can support cross-sector occupational mobility (interview EFFAT).

The sector is already facing labour shortages in some MSs (in Germany there is a shortage of VET-trained workers). Digitalisation and automation are shaping the labour market in the sector in most countries. EFFAT anticipates that in the area of production, **workers will most likely be hired for knowledge-based production roles, rather than manual work**. The need for upskilling is linked to the move towards Industry Food 4.0., and to an area where digitalisation plays a central role in production and distribution.

Tourism

Employment in the tourism industry relies on many young low-skilled workers, holding temporary jobs. Their skills can be adapted for ecotourism. If mass tourism becomes a fading concept, a number of low-skilled workers will need to leave the sector for other jobs. A structural shift may also become reality for medium and low-skilled workers. Many medium and high-educated workers have transferable skills and can get jobs in other sectors (interview EFFAT). Instead, new skills and occupational profiles may emerge.

The Spanish occupational observatory of the PES has identified the following green occupational profiles in the tourism sector: sustainability strategy consultants, designers and consultants in energy efficiency projects and tourism development, rural tourism and agri-tourism specialist technicians, green employment project technicians (SEPE, 2020). Morning Future powered by the Adecco group had identified the sustainable cook as one of the 10 most demanded green occupations³⁸. This type of occupation does not require major upskilling.

Transportation

The impact of greening jobs in the sector of transportation has mainly led so far to the need to add knowledge and skills within existing occupations, e.g., **eco-friendly driving**

³⁸ A sustainable cook is careful about using locally sourced production, quality brands, organic production and especially on avoiding waste, favouring reuse of materials and excess.
<https://www.morningfuture.com/en/article/2020/01/24/2020-green-jobs-most-in-demand/833/>.

to reduce emissions, use of electrical vehicles, new knowledge and skills among vehicle mechanics and technicians (e.g., conversion of existing vehicles to compressed natural gas). At medium skill level, this affects occupations related to use, **conversion (greening) and maintenance** of existing vehicles. At high skill levels, occupations that will shift focus are those in research and development related to the design of greener transportation systems, such as engineers and system analysts (ILO, 2019). **IT skills** will be in demand for occupations and tasks for mobility services (these may be created within the transportation system, the automotive industry, or IT-services providers). **Mobility services** encompass things like e-hailing and car sharing and plenty of digital services such as navigation apps, remote services (predictive maintenance, software updates), advanced driver assistance systems. Also, a new market for **smart transportation systems** (new toll systems, new traffic control systems) will emerge requiring such skills (IndustriAll, Automotive Policy brief).

Sewerage and waste management and other environmental goods and services

According to the circular economy scenario presented by Cambridge Econometrics et al. (2018), by far the most significant circular economy-related impact is on employment in the sewerage and waste sector. The sector is forecast to gain around 650 000 jobs in the EU28 (+50.77%). New jobs will be distributed across a range of occupations. Estimates of OECD (2017) show a similar magnitude of potential job creation. Industries in sectors like pollution management and control, waste collection and treatment, and recycling provide nearly 3.5 million, among which 1.8 million are in the area of recycling. By increasing the recycling rate from 50% to 70%, up to 322,000 direct jobs could be created. Taking into account the indirect and induced jobs, up to 550,000 total jobs could be created in the EU27. Potential employment gains can be expected, although the transition to a circular economy will generate less waste (OECD, 2017 Employment implications of green Growth).

Overall, the study of Cambridge Econometrics et al. (2018) concludes that there is a cross-cutting nature to some of the skills and competences required for key sewerage and waste occupations, especially at the elementary and intermediate levels (e.g., processing, monitoring/compliance, maintaining records). This would indicate that additional labour demand could be met from the existing pool of supply. The main challenge from a skills supply perspective might relate to attracting people to a range of technical and non-technical roles (e.g., business and administration associate professionals).

The refuse workers and other elementary workers is the largest group of workers in this sub-sector. They are mostly low or lower skilled. An analysis of required skills and competences on the basis of ESCO finds a relatively high degree of commonality in skills and knowledge requirements across the different job roles of refuse collector, recycling worker and sorter labourer. The study concludes that the circular economy is likely to bring new knowledge requirements but will not fundamentally transform the job (Cambridge Econometrics et al., 2018).

Significant occupational change in waste and recycling, including in research and development activities, is related to greening the economy. A medium skill level for occupational profiles may be expected for environmental engineering technicians, soil and water conservationists and environmental engineering technicians. High-skilled occupations undergoing change include environmental engineers, atmospheric and space scientists, soil and water conservationist, landscape architects, environmental restoration planner, environmental certification specialist, environmental economists, industrial ecologists, water and waste-water engineers, energy manager and energy auditors.

4.3 Generic green skills, transversal skills and core skills for the ecological transition

Generic green skills

Cedefop defines green skills as ‘the knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society’ (Cedefop, 2012 cited in OECD 2017a). The notion of ‘generic green skills’ refers to a set of soft skills³⁹ and technical skills. Generic green skills include general knowledge, attitudes and values, and they are necessary for contributing to sustainable social, economic and environmental development in any job.⁴⁰ These skills enable a person to develop a green mindset and adopt generic operational practices that minimise environmental impacts.

Generic green skills can be classified into⁴¹

- Cognitive competencies: environmental awareness and a willingness to learn about sustainable development, systems and risk analysis, ability to assess, interpret and understand both the need for change and the measures required, ability to identify opportunities and create new strategies to respond to green challenges.
- Interpersonal competencies: coordination, management and business skills to facilitate holistic and interdisciplinary approaches that encompass economic, social and ecological objectives, communication and negotiation skills for discussion of conflicting interests in complex contexts, marketing skills to promote greener products and services.
- Intrapersonal competencies: adaptability and transferable skills that help workers learn and apply new technologies and processes required to green their jobs, entrepreneurial skills to take the opportunities presented by low-carbon technologies.
- Technological competencies⁴²: quantification and monitoring (waste, energy, water), management systems (waste, energy, water), procurement and selection, material use and impact quantification, impact and use minimisation, impact assessment, risk management.

Similarly, the **ILO** has identified a number of **portable skills, which are applied to the greening labour markets**, including strategic and leadership skills, willingness to learn about sustainable development, management and business skills as well as entrepreneurial skills, consultation skills to advise consumers, systems and risk analysis as well as language skills and IT skills. It is thus necessary to include environmental awareness into the training of these generic skills⁴³.

A study on skills needs for **biodiversity** conducted in 2012 on behalf of the European Commission identified similar generic skills, namely general awareness raising and understanding of biodiversity and ecosystems; knowledge of related legal requirements;

³⁹ Note that there is no common definition of notions like ‘skills’, ‘competences’, ‘generic skills’, ‘soft skills’, ‘transversal skills’. Sometimes these notions are used synonymously. Sometimes, specific meanings and definitions are associated with these notions.

⁴⁰ <https://www.greenskillsresources.com/category/generic-green-skills>, accessed 12 March 2021.

⁴¹ <https://www.greenskillsresources.com/category/generic-green-skills>, accessed 12 March 2021, based largely on Pavlova (2014) and a study of Per capita.

⁴² It can be debated whether technological competencies can be included into the category of generic skills. It is justified if transferable elements of the technical skills are put forward.

⁴³ Olga Strietska-Ilina, presentation Green skills for green jobs presentation, ILO.

as well as communication and negotiations skills. These skills requirements add up to technical skills that had been identified at that time (ICF, 2012). The most encompassing overview of occupations and (mainly technical) skill sets, as well as training opportunities, is provided by the French catalogue of biodiversity-related jobs⁴⁴.

Core skills and fields of knowledge relevant for a circular economy have been identified by the **Spanish PES** through the above mentioned (Section 4.1) prospective study on **circular economy**: A key occupation identified by the experts interviewed in the study is the Circular Economy Manager. This profile is responsible for managing and organising the different actions, phases and processes involved in circular economy strategies and demands a specialist in the different sectors within the scope of the post. The following are also identified as core skills and fields of knowledge for the circular economy: Life Cycle Assessment (LCA); carbon footprint; water footprint; implementation, development and financing of the circular economy in general; strategic sectors, environmental vectors, materials and waste; regulations and legislation.

In France the ministry for ecological transition has identified **competences needed for the circular economy**⁴⁵. The applied eco-concept differentiates between competences, such as analytical competences, use of technologies and problem-solving skills applied to the production and distribution of goods, and knowledge (for example, in the area of materials, physics, chemicals, production processes, regulatory issues, specific norms, public tenders). It is acknowledged that specialists in eco-conceptions are mainly demanded in combination with other skills and competences in the SME sector.

Making transversal, generic and technical skills transferable

The forecast by Cambridge Econometrics et al. (2018)⁴⁶ on the employment effects of a shift towards a circular economy, suggests that the general trend towards increased demand for cross-cutting competences, such as problem solving and communications is reinforced. It points to the importance of transversal skills, as workers will need to be adaptable.

Thus, a major issue is to disentangle not only the need for upskilling but also the potentials for transferability of skills, which may need to undergo upskilling to ensure a match. In **France**, a **toolkit has been developed to identify transversal skills** and promote **transition in the labour market**. Transversal skills are defined as 'generic skills that can be mobilised in different job situations and occupations'⁴⁷. The development of the toolkit was based on local experiments in three regions. One of the tools consisted in identifying occupations at risk in the context of economic restructuring and 'green' or 'greening' occupations in the local area. On this basis, pathways for occupational transition for specific occupations were built up (see Examples in Box C1 in the Annex).

4.4 Conclusions

Overall, the agricultural and energy sectors are among the most affected by green policies, according to the OECD (2017). It is also expected that the construction industry will see employment gains, but new skills and knowledge will be required. A circular economy

⁴⁴ metiers-biodiversite.fr.

⁴⁵ Ministère de la transition écologique 2020, Compétences pour l'économie circulaire.

⁴⁶ Cambridge Econometrics, Trinomics, and ICF 82018), 'Impacts of circular economy policies on the labour market' Final report and Annexes, European Commission.

⁴⁷ «Compétences génériques mobilisables dans diverses situations professionnelles »Centre d'analyse stratégique, La Note d'Analyse Travail-Emploi, Avril 2011.

scenario would increase the number of jobs mainly in the area of sewage and waste. An electro mobility scenario would engender job losses of conventional blue-collar mechanical jobs in the automotive industry. As a general trend, the greening of the economy will further pressure on the already existing trend towards digitalisation.

Overall, large movements of low-skilled workers across sectors can be expected, as both job creation and job destruction will quite likely be significant. The broad level of skills required for different job types tends to be rather homogeneous. The OECD (2017) concludes that the overall employment effect of broad green policies that affect many sectors of the economy is unlikely to require a major increase in the levels of initial schooling, although they undoubtedly will require considerable retooling as regards fields of study and vocational skills. For high-skilled workers, the green transition offers new job opportunities. However, occupations and skills requirements may change quite fundamentally in some sectors, like the automotive sector.

5. TYPOLOGIES FOR GREENING LABOUR MARKETS

Based on the findings of the previous sections a typology for greening labour markets is proposed in this section and its consequences for PES discussed. The objective of the typology is to help PES to develop their strategies and measures, by reflecting in which labour market context, economic restructuring context, greening pathway and technological transformation context they find themselves.

5.1 Drivers for transformation

The greening pathways and the speed of transformation will depend mainly on the following drivers for transformation.

- (1) Political commitment (level and expected structural effects).
- (2) Focus on pathways towards greening the economy (energy efficiency, reducing GHG emission and energetic transition, circular economy, increasing biodiversity, promoting greening in specific sectors).
- (3) Changed consumer behaviour: policies directed towards changes in society / consumer behaviour, including green taxes, transportation systems; changed position on the global market, such as specialisation in environmental technologies vs import of these technologies).
- (4) Room for local political commitment as a basis for bottom-up transformation as a driver for change. This would have an impact mainly on a transversal and comprehensive ecological transition.
- (5) The role of technology-driven transformation (digitalisation, engineering solutions, technicians for implementation). This may also have an impact on an MS's position on the global market, for example specialisation in environmental technologies, vs import of these technologies).

5.2 Impact on employment

The employment impacts may change within a given sector, depending among other factors on the role of technology. Cambridge Econometrics et al (2018) point to divergent labour market impacts of the circular economy: Central and Eastern European countries would have larger GDP and employment gains, primarily due to larger reductions in oil imports in these countries. Countries in Western Europe would be more affected by a decline in production of electronics and cars. Diverging trends can emerge within one

industry, depending on the regional specialisation (e.g., production in the car industry: conception, development and/or production; see Annex Figure A2).

The employment impact also depends on the combination of patterns of labour supply and the use of technology, as the example of greening the agricultural sector shows: whether there is in the first place an increasing demand for low-skilled labour through organic farming or in the first-place increased needs for technicians and high-skilled workers using digital technologies to optimise production processes, may differ from one region or country to the other.

Although net employment gains are forecast to be small but positive, the impact can be quite diverse across regions and countries with either (i) a great deal of job destruction and job creations, but without substantial net loss of jobs. This can be expected for the majority of countries and regions; (ii) substantially more job losses than job creation and (iii) substantially more job creation than job losses.

5.3 Impact on skills

With regard to changing skills requirements, four categories of occupations can be distinguished⁴⁸.

(i) **Occupations that require awareness-raising** and small learning modules with respect to environmental constraints. This will be achieved through awareness or sensitisation modules in initial or continuing training. For example, the training of road drivers now includes eco-driving; forester.

(ii) **Occupations that require a low level of adaptation of skills.** This can be achieved by adding new modules to, or by redesigning, the training path. This concerns, for example, operatives involved in the maintenance of green spaces who will be trained in rational water and waste management or in new techniques of depollution by plants; welder in wind turbine production; organic farmer.

(iii) **Occupations that need a higher degree of skills adaptation.** This requires shorter courses or longer continuous training. This concerns, e.g., energy consultant in building; mechanic for electric cars.

(iv) **New occupations appear.** The French association for the employment of experts and managers (APEC) found that between 2005 and 2014, new occupations were mainly concentrated in the areas of auditing, consultancy, energy, biodiversity protection and eco-mobility. These new jobs can be located either in 'green' jobs (engineers and technical managers of the environment), or in greening jobs (engineers and managers in the building sector). Other examples are solar energy technicians, eco-designer and biofuel technicians. Such new specialisations require the creation of new education and training modules or courses. It may be expected that the demand for these new occupations will increase and that new occupational profiles will still emerge, if the ecological transition is speeded up.

5.4 Challenges related to the local labour market context

(i) Labour markets with a high share of low-skilled workers, as these are in general more likely to be unemployed and remain unemployed for longer periods of time.

⁴⁸ Observatoire régional des métiers PACA, 2014 cited in Cedefop 2018 [France] and ILO/Olga Strietska-Ilina, [ILO presentation Green skills for green jobs presentation].

(ii) High unemployment rate, social exclusion: this points to already existing structural problems in the labour market and/or in volatile labour markets and/or sluggish labour demand.

(iii) Ageing labour markets pose an additional challenge for placement (as hiring rates for older workers tend to be very low) and as older workers, in particular low skilled older workers, are less likely to participate in upskilling measures. Expectations and motivation for change may also be more difficult to handle.

(iv) Skills shortage: Skills shortages occur not only in countries with a low unemployment rate (e.g., in Germany⁴⁹), but also in countries with higher unemployment rates. Thus, skills shortages may occur for professions related to renewable energies (e.g., technician/installer of wind systems, installer/photovoltaic solar systems technician, installer/technician of thermal systems for renewable energies, energy management and control specialist) as mentioned by the Portuguese PES. The Spanish PES estimates on the basis of LFS data in its prospective study on the circular economy that the unemployment rate of those with occupations related to activities in the circular economy is only 5.2% as compared to 14.5% for the whole economy (SEPE, 2020)⁵⁰. This would indicate a high demand for these occupations and potential skills shortages in some of them.

Based on these factors and their interaction, and considerations about skills implications and transitions, the following five typologies of greening labour markets are disentangled. These types of green labour market may coexist in a country as different labour market segments or may be predominant in a given local and regional labour market context. Also, the main driver effects of globalisation have not been taken into account. For each of the typologies the main driver of changes, the endowment of the region with technology, skills and nature (as key production factors) are shown, main challenges and opportunities pointed out and the type of impact on the labour market transition pencilled in. Some conclusions for policy implications for PES (and potentially other key actors) are drawn.

⁴⁹ Skills shortages for environmental engineers have already been acclaimed a decade ago (Cedefop, 2012). Energy, water and environmental engineers as well as VET trained technicians for the shift to the construction of e-vehicles and crafts are still bottleneck occupations.
<https://www.wiwo.de/politik/deutschland/denkfabrik-herausforderung-jobs-schaffen/6062234-2.html>.

⁵⁰ The prospective study of SEPE has identified skills requirements in the following areas: ecological design, biodegradability, composting, methanogenesis, evaluation, water footprint calculation, electromechanics, electrical engineering, machinery maintenance, mechatronics, metrology, hydraulics, pneumatics, automation, robotics (user or technical-programming level), welding techniques, turning, milling, and boring, computer numerical control (CNC), radiofrequency, blockchain, smart waste (Big Data), computerised traceability, inventory management, technology consulting, eco-labelling, certification systems, regulations and legislation, ecotourism, tourism sustainability, environmental quality of buildings, languages, risk prevention, lean management and quality. From this list the need for combining IT skills with other technical skills becomes clear.

1. Technology intensive greening labour markets

Main driver of change	Key labour market patterns / resource endowment	Challenges	Opportunities	Type of labour market transition
Political commitment; Development of technology Related behavioural change of consumers	Endowment with technologies and related skills (Mainly at high-skilled level as well as at technician levels).	Changing skills requirement within occupations can be disruptive in some sectors (automotive) and transformative in others. Automation and job losses (mainly low-skilled). Skills shortages: IT, specialised engineering and technicians.	Job creation for high and medium (VET trained)-skilled. High quality jobs. Employment of women in tech occupations. Transferring generic and technical skills between sectors, as well as within the sector or company.	Demanding transition. Increased internal mobility (within companies). Increased mobility of the same occupational group between sectors. Hybridisation of digital, 'green' and conventional skill.

Source: own elaboration.

Policy implications (for PES in particular)

- Workers' and unemployed people's need for skills adaptation, upskilling (adding new skills/modules); flexible training programmes for workers (afternoon and evening courses, etc.).
- Need to support cross-sector mobility of workers; supporting cross sector and occupational mobility for displaced workers whose skills have become obsolete; identify transferable skills.
- Need for close relations/cooperation with companies to support internal/cross-sector mobility, and to identify new skills and transferable skills.

2. Labour intensive greening labour markets

Main driver of change	Key labour market patterns /resource endowment	Challenges	Opportunities	Type of labour market transition
Political commitment for circular economy/ greening construction, agriculture, tourism Regional development strategies (e.g., for rural areas)	Endowment with a comparatively high share of low-skilled workers. Significant share of medium level skilled workers.	Manage cross-sector mobility and occupational mobility across sectors. Low quality jobs, physically demanding work. Labour shortage in low-skilled seasonal work in rural areas and medium- skilled green occupations.	Employment opportunities for low-skilled. Employment opportunity for tasks needing small additional skills (at all skill levels) In the medium and long-term shift to increasing skills content of jobs.	Mainly smooth cross-sectoral and cross occupational transition.

Source: own elaboration.

Policy implications (for PES in particular)

- Counselling for occupational and cross-sector mobility (motivation, flexibility, regional mobility may be issues); identify transferable skills; provide short training modules for occupations that require awareness raising; support on- job training to ease transition.
- Need for other ALMPs e.g., to support regional mobility, entrepreneurship development (e.g., in agriculture, tourism).
- Increase attractiveness of seasonal employment; need for good/close cooperation with local stakeholders and good knowledge/information about regional strategies.
- Adapt PES capacity (staff and funds) to manage large flows of unemployed; need for financial support for unemployed; other financial support for some categories such as seasonal workers; PES capacity to work in remote areas.

3. Disruptive greening labour markets: shifting rapidly from polluting to green industries

Main driver of change	Key labour market patterns / resource endowment	Challenges	Opportunities	Type of labour market transition
Political commitment for climate objectives / energy transition Regional structural policies	Regional concentration of polluting industries (fossil energy production, energy-intensive industries). Growing renewable energy sector.	Skills become obsolete. Mid-aged and older workers at risk of job loss. Threat of long-term unemployment. Skills shortages in the green industries at medium and high-skill level	Medium skill and high skill level jobs in the renewable energy sector and other sector	Structural skills mismatch. Skills are not easily transferable from one subsector to the other.

Source: own elaboration.

Policy implications (for PES in particular)

- Need for active labour market programmes and other social protection schemes to mitigate the social consequences of unemployment. Need for close cooperation with social partners (e.g., for establishing social plans, training and outplacement activities).
- Intensive networking with training institutions to provide the necessary training programmes in due time.
- Need for intensified counselling/career counselling to avoid long-term unemployment and to support workers in their transition from one job/sector to another; post-placement support.

- Cooperate with other regional stakeholders on identifying potential sectors of growth, identify and train unemployed with upskilling and reskilling potentials for jobs in demand in the local economy.
- Need for ALMPs to support regional mobility; need for cooperation with local stakeholders to provide social infrastructure/accompanying measures (child-care, quality schools, housing etc.) to attract workers from outside the region into new economic sectors.

4. The repair and preserve greening labour markets

Main Driver	Key labour market patterns / resource endowment	Challenges	Opportunities	Type of labour market transition
Political commitment to circular economy, climate neutrality and biodiversity Changes in consumer behaviour Regional development policies for nature conservation and ecotourism	Medium-skilled and low-skilled workers; Nature.	Difficulty in retaining skilled labour force in rural labour market. No large job creation to absorb unemployed from the production sector. Shift from global 'production' to local 'repair' tasks may engender skills mismatch.	New employment opportunities. New occupational profiles with easy pathways for upskilling / add new skills at all skill levels. Slight increase in quality of jobs.	Small volumes of labour market transition. Shift from specialisation to polyvalent skills sets.

Source: own elaboration.

Policy implications (for PES in particular)

- Providing upskilling opportunities; small upskilling modules for ecological awareness raising.
- Promote job creation for absorbing unemployed who have skills that are not easily transferable; need for other ALMPs – e.g., entrepreneurship development.
- Cooperation with local authorities/stakeholders to provide other type of support for small/family businesses and retain skilled labour force in regions.

5. Evolutionary greening labour markets: hybridisation and deep transformation over time

Main Driver	Key labour market patterns / resource endowment	Challenges	Opportunities	Type of labour market transition
Political commitment and broad consensus for greening Bottom up and top-down political initiatives Technology Changed consumer behaviour Shift in demand towards low energy consuming services	Mixed labour market patterns, no specific endowment. No concentration of declining polluting or dynamic green industries.	Not too big challenges for skills adaptation but divergent pictures: high volume of job destruction and job creation calls for increased flexibility. All occupations are affected by 'greening' tasks. Adding new skills and competences at all skill levels. Risk of leaving behind those with low learning capabilities.	Employment opportunities at all skill levels across sectors. Substantial growth of emerging and new occupations. Improving job quality for most jobs over time	Partly challenging, and partly smooth transitions Deep transformation with 'green skills' becoming basic skills and with higher levels of technical 'green skills' in medium and highly skilled occupations.

Source: own elaboration.

Policy implications (for PES in particular)

- Need for adaptation of skills, reskilling, upskilling: mainly need for awareness raising in occupational profiles; and mainly need short and long-term skills adaptation; new occupations emerge (at a slow rate).
- Need for intensive counselling and working on jobseekers' motivation, especially for disadvantaged people (such as those with low learning capabilities); need for career guidance to support job/sector transitions.
- Need for close cooperation with companies to support transition within companies, including through training/retraining; PES can be a partner in bottom-up initiatives for greening the economy.

6. POLICY RESPONSES IN THE AREA OF EMPLOYMENT AND SKILLS

The EU Circular Economy Action Plan aims to create new markets for climate-neutral and circular products, such as steel, cement and basic chemicals, which are energy-intensive industries (Bruyn et al., 2020). It will focus activities on electronics and ICT ('Circular Electronics Initiative'), batteries and vehicles, packaging, plastics, textiles, construction and buildings, and food⁵¹. In addition, the European Commission adopted a new EU Strategy on Adaptation to Climate Change on 24 February 2021⁵². The European Green Deal Investment Plan (EGDIP), also referred to as the Sustainable Europe Investment Plan (SEIP), will mobilise at least one trillion Euro in sustainable investments over the next decade. Part of the plan, the Just Transition Mechanism, will be targeted at a fair and just green transition. It will mobilise at least 100 billion Euro in investments over the period 2021-2027 to support workers and citizens of the regions most impacted by the transition⁵³. The EU Just Transition Fund, as the first pillar of the Just in Transition Mechanism, is a new instrument with an overall budget of 17.5 billion Euro⁵⁴. It aims to alleviate the social and economic costs resulting from the transition towards a climate-neutral economy, through a wide range of activities directed mainly at diversifying economic activity and helping people adapt in a changing labour market (see Annex Table A1, and section 6.2 for a few examples). In addition, EU MSs have been implementing their own measures and programmes.

Section 6.1 gives an overview of main policy responses to promote the transition towards greening the labour markets. Section 6.2 recalls the main challenges for PES and briefly reviews how PES activities fit into the wider employment and skills policy eco system. Concrete good practices or interesting measures implemented by PES will be looked at in section 6.3. These examples are intended to serve as an inspiration for designing and scaling up future PES activities and are not intended to be fully comprehensive.

6.1 Overview of policy responses in the employment and skills ecosystem

Programmes to promote the creation of green jobs

Countries have started to implement programmes with the dedicated objective of creating green jobs. For example, in **Austria**, the Green Jobs Master Plan ('MEHR JOBS DURCH GREEN JOBS!') was launched in 2010⁵⁵. Its main goal was to raise the number of green jobs from around 185,000 by another 100,000 employees by the year 2020. The master plan was focused on three main areas: (i) agriculture and forestry; (ii) environmental technology and renewable energy as well as; (iii) tourism and leisure industries. To increase the number of green jobs, the Master Plan included measure such as the provision of innovative and need-based further training and education options in the environmental management sector.

The European Social Fund has been used to promote the creation of green jobs in Spain. **The 'employ green' Empleaverde Programme in Spain**⁵⁶ is an initiative of the Biodiversity Foundation and is implemented by the Ministry for the Ecological Transition

⁵¹ https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

⁵² https://ec.europa.eu/commission/presscorner/detail/en/ip_21_663, accessed 14 April 2021.

⁵³ https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_24, accessed 14 April 2021.

⁵⁴ https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2354

⁵⁵ <https://www.bmk.gv.at/en/topics/climate-environment/sustainable-development/green-jobs-masterplan.html>.

⁵⁶ <https://www.empleaverde.es/programa-empleaverde>.

and the Demographic Challenge. The programme aims to create jobs, improve employability and support business creation in the green and blue economy, with special emphasis on a circular economy linked to nature conservation and low in carbon. New calls within this programme target unemployment, women, young people up to 35 years of age, over 45, immigrants, people with disabilities and residents in protected areas and/or rural areas (for details see Box C2 in the annex).

In a policy scenario aiming for a substantial ecological transition, these types of policies, programmes and initiatives are likely to be launched also in other EU MSs, or existing activities scaled up.

Education and training

There are several pathways for skills adaptation needed for the greening of the labour market.

(i) On-the-job learning and training as well as continuous learning offered by companies and internal mobility of workers. Challenges may emerge for SMEs that do not have the organisational and/or financial capacity for upskilling.

(ii) Individual investments of workers to update and adapt their knowledge and skills and internal or external mobility of workers.

(iii) Public and private employment and placement services to support occupational and cross-sector transitions. In case of large-scale restructuring, social plans may be linked to reskilling activities and placement activities by outplacement agencies, transfer agencies and the PES.

(iv) Acquiring skills for new occupations through graduating from the VET and the tertiary education system and acquiring generic green skills at all levels of education.

The PES will become an important partner for smoothing the transition in the labour market through placement, guidance and upskilling, and reskilling activities.

Introducing greening skills into vocational education and training (VET) and continuous training

Introducing green skills into VET for 'conventional' occupations has started in several countries. Introducing green skills into VET requires as a first step the identification of required green skills (see also section 4 above). Box 1 gives an example where this has been investigated and developed for the steel industry. This project gave rise to another project that looked into the transferability of these skills to the automotive sector.

Box 1. Greening Technical-Vocational Education and Training in the steel and automotive industry

The Greening Technical-Vocational Education and Training (GT VET) project developed a model for an industry-driven European sustainable training module in correspondence with national VET systems. A partnership of steel companies and research institutes from each participating Member State, identified and anticipated the impacts of environmental legislation on the everyday work of mechanical/industrial technicians and electrical technicians (for today and the future). The project published a Greening Technical VET Sustainable Training Module for the European Steel Industry handbook⁵⁷.

The project Green Star aimed at transferring and adjusting the GT-VET module for large companies to SMEs in the automotive sector and to a heterogeneous field of professional occupations along the value chain. Two submodules of GT VET were adapted ('Energy') or modified ('Waste'), and a submodule ('Life-Cycle Assessment') added to form the Green Star training module of 'Green skills along the value chain of the automotive suppliers' industry. Green Star was supported through the EU Leonardo da Vinci programme and led by the Italian employers' confederation Confindustria. It included sector stakeholders at local level from Germany, Italy, Romania and Spain.

Source: www.greenskills-project.eu , www.gt-vet.com.

In **Germany** ESF has been used since 2015 for environmental and climate protection with 14 projects in the field of construction and building renovation. The Federal Environment Ministry launched a project to support sustainability in the workplace, through using key generic competences for climate and resource-friendly activities. The projects focus on two areas: (i) 'in-work camps' for career orientation for young people permitting them to try out a variety of professions and experience sustainable action in everyday working life, (ii) courses for trainees and training staff on cross-disciplinary cooperation in energy-efficient building renovation and in new buildings (Umweltbundesamt, 2020). Promoting VET and continuous training are two pillars of the government's strategy to overcome skills shortages, which may become a barrier for greening the economy⁵⁸.

Promoting continuous training is important for certain categories of workers through targeted programmes. Support for continuous training is also relevant for **SMEs**, as they face challenges in upgrading the skills of their workforce to the new skill requirements due to a limited ability to provide training. Supporting SMEs for training/retraining their employees and advising them on how they can get support and raising awareness about the need to invest in training for the ecological transition is crucial (interview Eurochamber and OECD, 2017). Eurochamber argues that training opportunities concentrating on skills for green transition need to be financed and organised by the public authorities. Education on the green economy should start already in schools, including the VET-providing institutions (Eurochambers 2020).

Energy-efficient construction and retrofitting, renewable energy, recycling, and environmental services appear to be the sectors which can benefit most from targeted initiatives to promote training, since they tend to require workers equipped with new skills. As the impact of the green transition will vary across geographic regions, involving local actors (including the PES) can be crucial in identifying the skills of the local work force in declining sectors which are transferable to emerging sectors (OECD, 2017).

⁵⁷ <https://www.estep.eu/assets/GT-VET/GT-VET-European-Framework-Module-Green-skills-for-mechanical-industrial-and-electrical-technicians-Training-Handbook.pdf>

⁵⁸ In Germany, the government has also defined immigration of skilled workers as a way to overcome skills shortages, alongside VET education, continuous training and increasing female employment. Another approach has been to increase the interest of young people in technology, starting at young ages (Cedefop, 2012).

From a lifelong learning perspective, the challenges for the education and training system are substantial: a transversal approach is necessary, which means integrating basic knowledge on climate change and ecological transition in all type of curricula, including in continuous training.

Costs for labour market transitions and social investments

The EC has estimated the costs of reaching climate neutrality in terms of labour market policy expenditure (or social investments), consisting in income-replacing benefits and expenses for (re-)skilling workers. Model assumptions are that 20% of displaced workers are able to find a new jobs in other sectors within three months and without any further training, 1.3% would move into early retirement, and 78.8% will become unemployed. They receive unemployment benefits and re-training costs occur. 86% of the cost falls on unemployment benefits, 11% on retraining and 3% on early retirement expenses. A heavier transition could double these costs over time. It is assumed that 31% of those unemployed would participate in training in a climate neutrality scenario and 50% in a more ambitious climate neutrality scenario. A more ambitious transition scenario may also engender longer unemployment spells and longer training periods. Estimates show that a heavy transition to climate neutrality would require significant social investments in two waves until 2050 (see Annex Figure A3).

6.2 Challenges and (potential) strategies of PES

Challenges

The main challenge for PES consists in managing the labour market transitions linked with the ecological transition. Transitions are likely to affect all skill levels (see section 4). Variations in the magnitude and depth of transformation **vary by sectors, occupations and regions**, as well as groups of workers. Understanding which skills are transferable and which additional 'green skills' will be needed in the different occupations is a difficult task. It will become necessary to bundle the knowledge and insights of all different actors in the labour market. **Labour market information and skills anticipation systems** need to grasp skills requirements not only at national level, but also at local level. Another challenge is to improve the labour market information system in a way that eases its use by PES staff. As pointed out by the Norwegian PES, it will be necessary to improve digital tools for jobseekers, e.g., for example for providing information on jobs or professions in demand on the labour market, and opportunities for training/re-training, and thus to improve self-service (interview with the Norwegian PES).

Older workers are overrepresented in polluting industries, and this is challenging for PES both in terms of placement as well of up- and reskilling (OECD, 2017). Self-employed workers, unpaid family members, and workers who cumulate employment spells of short duration usually have less access to continuing training. Upskilling **low-skilled** workers in order to prepare them to new tasks and jobs will be another challenge. Previous crises have shown that low-skilled workers have been replaced by medium-skilled workers and medium-skilled workers by high-skilled workers (interview with the Portuguese PES). Low-skilled and disadvantaged groups may also face difficulties to find green or greening jobs in a context of low unemployment, if green jobs are already quite technology intensive (interview with Norwegian PES).

The greening of the economy will go hand in hand with **digitalisation**, and thus reinforcing the need for upskilling in digital skills and bridging the **digital divide**. In general terms,

ALMPs need to include a **gender dimension**, as many technician and IT jobs, which are relevant for the green transition, are still male dominated.

While investments in the recovery plans aimed at supporting the greening of the economy mainly include tax reductions, grants and loans and subsidies to R&D, few measures are dedicated to skills training, mainly in the energy sector and forestry (OECD, 2020). Skills development measures are costly and there is the danger that **budgets for ALMP** are not raised as much as needed (interview with ETUC).

Another challenge is linked to the low quality of many green jobs requiring a low educational level, in particular in the area of waste, and in agriculture (seasonal employment). This may hamper a smooth transition towards green jobs in the low-skilled labour segment. Transition within medium-skilled and within-high skilled jobs may also be difficult in the event these are associated with lower **labour standards** (e.g., a lower wage level). This could be relevant for bringing displaced workers from e.g., the mining sector, or the automotive sector to accepting lower paid jobs in other sectors.

PES could take over a more active role in promoting the greening of the labour market in local partnerships. Note that responsibilities between actors are distributed differently across EU countries. In particular, not all PES in the EU have the mandate to support skills adaptation under specific conditions in companies with the objective to reduce job losses as well as to prepare for occupational transition as long as the workers are still employed. Also, there are a multitude of actors providing vocational guidance. **Multi-actor partnerships** offer opportunities but are also challenging as they require a mindset shift and openness of all actors. Developing PES activities in close cooperation between government, trade unions, and employers' associations will be essential for smoothing the ecological transition, especially in countries with a strong and mature social partnership model (interview with the Norwegian PES).

PES responses and strategies

Managing labour market transitions involves placement of workers across sectors and occupations, as well as within sectors. As far as the scope of PES responsibilities permits it, it also involves providing advice to workers at risk of becoming unemployed because of the energy transition and giving advice to SMEs to support them in their HR strategies and skills adaptation strategies and support them for adapting the skills of their workers. Providing vocational guidance for young people and adults on keeping the skills requirements for the ecological transition in mind is another important area of activities of PES. A core activity of PES is to support job seekers to acquire the skills needed, including skills in green or greening jobs, supporting start-ups in the green economy, as well as mitigating effects on groups of workers whose skills will become obsolete. These activities represent the core business of PES. However most PES have not yet given specific attention to green jobs or challenges linked to the greening of labour markets (European Commission, 2013, Cedefop 2018a). However, in France, the PES has been involved in green jobs and skills issues for a decade (e.g., in the area of detecting skills requirements and establishing occupational profiles, see sections 2 and 4). Also, other PES have implemented relevant activities and a growing awareness can be observed in some countries, in particular induced by recovery plans.

Denmark has had a long-term focus on integrating environmental and climate issues into its educational and vocational training systems. Interestingly, Denmark does not have an explicit green jobs programme. Instead, its ministry of employment has focused on ensuring that the labour market is efficient and well-functioning (OECD, 2017). The active labour market policies have been an integral part of the Danish 'flexicurity model', with

significant expenditures on training measures and supporting change and transitions in the labour market.

In **Norway**, a systematic focus on societal trends and restructuring of the economy through for example digitalisation and the ecological transition supports awareness raising and planning of future strategies (see e.g., NAV's Horizon Scan 2021, the Norwegian PES).

Recently, the role of the **German** PES in promoting continuous training for specific categories of workers has been strengthened, which is a good starting point for managing future challenges. The German PES and active labour market programmes have traditionally played a role in supporting transition and economic restructuring in specific regions, including in the energy sector and energy intensive industries.

In **Portugal**, the government's Economic and Social Stabilisation Program of June 2020 foresees the modernisation of training services in order to respond to profound social, economic, technological and cultural changes, including the transition towards a 'green economy'. Accordingly, PES spending will include training in areas such as environment, renewable energies, energy efficiency and decarbonisation. An investment plan is already underway that includes the setting up of sections dedicated to renewable energies throughout the PES network of Training Centres, in order to improve and to expand the training opportunities in this area. The PES intends to implement qualification and retraining programmes for workers who lost their jobs and those who, while working, need to update their skills in order to maintain their jobs. As for the digital area, the **objective will be to work in direct cooperation with employers** in order to adjust the training on offer to specific needs (interview with the Portuguese PES).

In **Austria**, green jobs have already been on the agenda (although not as a priority) in recent years. As in the case of Portugal, greening the labour market is part of recovery plans, which gives a new impetus to PES activities with regard to green jobs. Starting from October 2020, the federal government's corona job offensive is endowed with 700 million euros, earmarking 485 million euros to qualification measures. According to current plans of the PES (AMS), apprenticeships for around 3,200 people are planned in the areas of environment, agriculture and forestry. In the electronics/digital technology area, 17 400 people are to be trained, and vocational training is also planned in the areas of photovoltaics, e-mobility and garden and green space design⁵⁹.

Slovenia is one of the countries which implemented some small-scale activities in the area of green jobs in recent years, although not in a strategic way. The PES approach became strategic beginning in 2020. To start with, the Slovenian PES is hosting an event on the issue of 'green jobs' in 2021 with participation by an employers' association and the Ministry of the Environment. The PES perceives its role as bringing together different stakeholders. Other activities include awareness-raising among PES staff (interview Slovenian PES).

PES role in partnerships to manage the transition from polluting to clean activities

One policy response is large in scale and links regional development policies with labour market policies in regions heavily affected by the energy transition. The past has shown that economic restructuring takes time. Regions with coal mining and energy intensive industries have been undergoing restructuring for decades. These regions are again the focus of attention. As mentioned at the beginning of section 6, the EU has set up a Just Transition Fund, and national and regional government have set up regional development strategies (see also Table A1 in the Annex on affected regions and proposed priorities by

⁵⁹ <https://infothek.bmk.gv.at/green-jobs-klimaschutz-ist-job-und-wirtschaftsmotor/>.

the European Commission). PES are one of the relevant actors for the implementation of these activities.

In the following section, three examples for managing the labour market consequences of the **coal** exit will be given, showing the mix between strategies to diversify the regional economy, upskill, reskill and place workers and early retirement.

(i) Germany

Over the course of 2020, the German government adopted two major legislative acts that govern the coal transition: the coal phase-out law and a structural development act. Both laws are conditional on each other, financial support for the regions is tied to a progressive phase-out of coal production and consumption in the region⁶⁰ (Roth et al. 2020). In order to support and shape the structural change in the regions affected by the coal phase-out, the Federal government has earmarked significant budgets for support the transition⁶¹. The German Federal Agency for the Environment has commissioned a study on the impact of the coal exit strategy and climate change policies (Umweltbundesamt, 2019). This study argues that one of the main strategies to manage the transition consists in skills policies. Skills development measures that have been decided are embedded in other regional development measures, for instance the setting up of competence centres (Umweltbundesamt, 2019).

According to the three local PES of the Rhenish Revier, one of the affected regions within the larger Ruhr area, the planned end of lignite-based power generation will affect around 28 000 jobs and suppliers by 2022⁶². The research institute of the Federal Employment Agency, the IAB, was tasked with conducting a labour market analysis of this region and has established a qualification and occupational profile of those working in the mines (mainly VET-trained qualification level). Around 70 percent of those employed in the lignite industry are over 45 years old.

The three local PES in the Rhenish Revier are cooperating, as they consider forming an economic region.⁶³ It is acknowledged that the companies and employees in the region need advice on change management and transition, individual funding opportunities, and offers to adapt qualifications to new economic structures. The local PES are dedicated to work towards the objective to sustain the economic restructuring of the region in new innovative industries, including renewable energies. The local PES offers support to companies and workers through training measures. (Roth et al. 2020).

(ii) Poland

Silesia in Poland is the largest hard coal mining region in the EU where more than 70 000 workers are employed in the mines. The region is in the middle of preparations for the transition away from coal. In January 2021, the Polish government presented [the draft of the Partnership Agreement](https://coaltransitions.org/news/the-future-has-just-begun-a-short-profile-of-the-rhenish-lignite-area/), which specifies how it intends to spend the funds available under the EU Multiannual Financial Framework 2021-2027. According to the draft, the Silesian region will receive EUR 2.8 billion to be spent via the Regional Operational Programme financed by the European Regional Development Fund and European Social

⁶⁰ <https://coaltransitions.org/news/the-future-has-just-begun-a-short-profile-of-the-rhenish-lignite-area/>, accessed on 7 April 2021.

⁶¹ <https://coaltransitions.org/news/the-future-has-just-begun-a-short-profile-of-the-rhenish-lignite-area/>, accessed on 7 April 2021.

⁶² <https://www.arbeitsagentur.de/vor-ort/bruehl/rheinisches-revier>.

⁶³ <https://www.arbeitsagentur.de/vor-ort/bruehl/rheinisches-revier>.

Fund Plus as well as an additional EUR 2 billion via Just Transition Fund (JTF)⁶⁴. The regional plan for Just Transition of the Silesian Voivodeship 2030 (TPST) was developed and is currently under public consultation. The plan is that the EU funding will support a broad set of measures aimed at strengthening and diversifying the regional economy as well as improving quality of life in the region.

With regard to the labour market impact, the Just Transition Fund is primarily intended to generate new jobs for people leaving the mining industry and related industries. It will also be possible to support the retraining of employees of large mining companies if the company's activities diversify and move away from mining activities in favour of a green and digital economy (interview, Polish – Silesia / Katowice PES).

(iii) Spain

The 250 million Euro Plan del Carbón will see the closure of all Spanish coal mines which are no longer economically viable. The agreement was reached between the government and the trade unions. The government will fund a transition that is expected to take place between 2019 and 2023. The Just Transition deal replaces subsidies to the coal industry with a sustainable development plan. The deal covers eight companies with 12 production units in four regions of Spain (affecting 1 677 jobs). A combination of restructuring and income support measures is implemented, including early retirement (60% of miners would be eligible), redundancy payments, and miners with asbestosis will receive an additional payment.

In addition, money has been set aside to restore and environmentally regenerate former mining sites. Priority for employment in these jobs will go to former miners. Budget is also earmarked to upgrade facilities in the mining communities, including waste management, recycling facilities and water treatment plants, utilities infrastructure and distribution for gas and lighting, forest recovery, atmospheric cleansing and reducing noise pollution. An action plan will be created for each mining community, including plans for developing renewable energy and improving energy efficiency, and investing in and developing new industries⁶⁵.

(Potential) partnerships at local level to promote the green economy

In **France**, the National Agency for the Ecological Transition Ademe has set up a number of initiatives in cooperation with the local 'jobs houses' (maisons de l'emploi⁶⁶), the French PES Pôle emploi, chambers and various other actors. Activities include skills analysis and skills anticipation for a greener labour market⁶⁷ and awareness raising activities⁶⁸. It also supports activities of the PES for placing long-term unemployed people into sustainability projects (in the context of the French programme Territoires zéro chômeur longue durée)⁶⁹.

⁶⁴ <https://coaltransitions.org/news/crucial-months-ahead-for-coal-transition-in-silesia-poland/>.

⁶⁵ <http://www.industrialunion.org/spanish-coal-unions-win-landmark-just-transition-deal>.

⁶⁶ <https://www.ademe.fr/projet-maisons-lemploi-developpement-durable-capitalisation-plans-daction>, <https://www.ademe.fr/transition-energetique-territoires-mobilisent-accompagnent-levolution-emplois-competences-filiere-batiment>.

⁶⁷ See for example : Hauts de France (2020) <https://www.ademe.fr/economie-circulaire-emplois-hauts-france>; Grand Est (2020) <https://www.ademe.fr/impact-lemploi-leconomie-transition-energetique-grand>; Pays de la Loire (2019) <https://www.ademe.fr/marches-emplois-lies-filiere-enrr-territoires-impactes-fermeture-dune-centrale-a-charbon>.

⁶⁸ E.g. <https://bretagne.ademe.fr/entreprises-et-monde-agricole/metiers-de-la-transition-ecologique-et-energetique/la-transition-ecologique-une-opportunite-pour-lemploi>.

⁶⁹ https://www.youtube.com/watch?v=xLspaQU2vIM&feature=emb_title.

In many EU MSs, the agricultural sector faces recruitment problems. Local partnerships, including PES, are necessary to attract people to **remote/rural areas** through specific programmes and accompanying measures (e.g., decent wages, child-care, quality schools, housing), offering attractive career paths; many of the green jobs will be in rural areas. A task for the PES would be to develop local strategies to attract workers in those areas, and prevent workers leaving rural areas. One activity could be to promote the image of sectors, reaching out to young people, to prepare workers to work in agriculture. Short-term seasonal work combined with training activities in the non-worked periods would help to retain workers in the sector (interview with EFFAT).

Potential partnerships with private employment services and job boards

Cooperation between private and public PES could represent an opportunity to increase matching efficiency for the green economy. A number of private job boards have been created for placement activities in the green economy⁷⁰. Potential partnerships between public and private employment services could be explored to widen access to available green jobs, as well as for assessing specific skills demands.

One example is the platform Greenjobs. The Greenjobs⁷¹ job board offers recruitment services to sustainable companies to find professionals with a sustainable mind-set. Recruitment services are offered for temporary and permanent employment, freelance work and transition from temporary to permanent employment and the green job vacancies that are available for jobseekers. Some online career advice is also offered to jobseekers – career advice on 'The WHY, WHAT and HOW of finding a future-proof job'. It is operating in several countries; Greenjobs.de has been operating since 2000 in Germany⁷².

Private employment services, which often act as both temporary work agencies and private placement and recruitment agencies, have targeted some of their activities to the green economy as well as to greening occupations in other sectors. This also includes activities to improve employability and to match the supply of and demand for skills⁷³. The Modis Academy (which is part of the Adecco group) offers upskilling opportunities to candidates and matches them with potential employers⁷⁴. These activities are generally targeted towards the high skills segment.

⁷⁰ <https://www.enelgreenpower.com/stories/articles/2020/10/green-jobs-renewable-energies>, <https://www.environmentjobs.com/aboutus.asp>, <https://www.jobsingreen.eu/>, https://www.glassdoor.com/Job/jobs.htm?suggestCount=0&suggestChosen=false&clickSource=searchBtn&type_dKeyword=green&sc.keyword=green&locT=N&locId=120&jobType=, <https://www.glassdoor.com/>, <https://www.totaljobs.com/jobs/environmental/in-sweden>, <https://graduateland.com/s/climate-environment-energy-jobs/sweden>, <http://gronajobb.se/>.

⁷¹ <https://greenjobs.nl/en/about-greenjobs>.

⁷² https://www.greenjobs.de/ueber_uns/index.html.

⁷³ See e.g., new publication of the Adecco Group, Green Skills for Jobs: <https://www.adeccogroup.com/research-block/skills-for-the-green-economy/>

⁷⁴ <https://www.modis.com/en-us/job-seekers/modis-academy-program/>.

6.3 Good practice examples

The following examples are mainly implemented by the PES. In some cases, the PES is a partner of a wider partnership.

Raising PES internal capacities for supporting green jobs: tools, training and internal good practice database

One area of action has been to raise awareness among PES staff and to train staff. Examples include the following.

- The **French** PES is offering online training on green and greening occupations for PES staff (online, 1-hour training). This is in line with the axes of the current strategic plan of Pôle emploi and fully in line with governmental measures related to Sustainable Development. Pôle emploi is also setting incentives for PES staff to implement and to show cases of innovative practices in supporting the green transition. The Pôle emploi intranet contains examples on how local Pôle emploi offices have been involved in actions related to promoting the green economy (also in partnership with other actors like municipalities). This not only helps to disentangle interesting practices but also serves to raise awareness among PES staff (interview Pôle emploi).
- In **Romania**, the ESF-financed Green Jobs project of the National Agency of Employment (NAE), running from 2011 to 2014, aimed to propose a system to identify and manage green jobs and occupations. Another study highlighted the key factors that influence the implementation of the new concept of green jobs in Romania. While the development of tools to identify green jobs and handle vacancies is important, the implementation of a green job strategy in the operations of the PES in a structural way may be challenging (interview with Romanian PES).
- The **Norwegian** PES NAV is running projects with universities to improve PES employees' knowledge on labour markets and their capacity to offer appropriate services and measures to their clients.

Providing information and vocational guidance

As shown in Chapter 2, some PES provide information and education training requirements for green and in some cases for greening occupations in a structured way (e.g., Austria, France, Germany, Spain) and have included the relevant information in their digital tools (at least in Austria, Germany, France) (see also Chapter 2). The French PES has also produced leaflets on green occupations (source: interview with the French PES).

Upskilling initiatives

Many PES are offering upskilling and reskilling to the unemployed, and in some case to specific groups of employed people who need to adapt their skills as part of their regular activities. These activities start with an assessment of training needs. The Spanish PES SEPE has identified specific training needs related to the circular economy (see Box C3 in the annex).

Good practices include projects that have detected specific skills needs related to the greening in a specific territory, which may serve as a pilot for other regions (see example of Italy in Box 2).

Box 2. The ‘Green & Blue Economy’ Programme in the Region of Sardinia, Italy

To support the development of the green economy, the Autonomous Region of Sardinia – through its Labour, VET, Cooperation and Social Security Directorate General – has developed a wide range of new training courses, in the frame of the Green&Blue Economy project launched in 2016⁷⁵, co-financed by ESF. The new courses, designed through a cooperation between local authorities and business communities, were related to roles within the green and blue economy⁷⁶, and training was provided by accredited vocational education and training professionals. One set of courses was designed to strengthen people's skills and knowledge in a subject area, with job coaching, internships, and training leading to certification. The second was designed to support people to start up their own business through consultations with local and international industry professionals, with work experience at similar start-ups in other countries. The planned number of participants in these training courses was of around 10.000 people.

Source: <https://ec.europa.eu/esf/main.jsp?catId=46&langId=en&projectId=3637>.

Dedicated programmes to promote upskilling for the green transition have recently been designed in the case of France. In May 2018, the French Ministry of ecological transition and solidarity and the Ministry of labour launched the initiative ‘10 000 training courses in ecological transition jobs.’ **The training will be co-financed by the French PES Pôle emploi** as part of operational preparations for ecological transition jobs. Main elements of this initiative consist in the training of employees in integration through economic activity that will be intensified, particularly in the **field of recycling, the circular economy and resource centres** (see for more details Annex Box C4).

Box 3 gives an example for the design of a combined training and employment incentive measure to integrate young unemployed people into green jobs in the construction sector in Luxembourg.

Box 3. ‘Fit4Green&Build Jobs’ in Luxembourg

To support the development of the construction sector and support sustainable professional integration, the Employment Development Agency (ADEM) and the Building Sectoral Training Institute (IFSB) with the support of the ESF developed the national project ‘FIT4 Green & Build Jobs’. The project was launched in 2015 for an initial period of 30 months (July 2015 to Dec 2017), and the practice was extended in 2018 to the end of 2020. Young people⁷⁷ aged 18-29 years old, registered with PES, were the target group of the project (the planned number of participants by the end of 2018 is 223 people). They benefitted from various training courses related to the construction sector. After training, the trainee was awarded a contract as an assistant worker with a company which participated in the programme. The contract is subsidised up to 50% of the salary for 12 months, with the aim that the trainee will be offered a full-time contract after this period.

Source: <http://fit4greenjobs.lu/>

Employment incentives

Employment incentives have traditionally been used by PES to bring workers with employment barriers into work, by subsidising wages for a limited period of time, in order to compensate employers for a temporary lower productivity of the worker because of a lack of experience. It has also been used in creating additional demand for labour in times of recession. Employment incentives in principle can also combine the objective to bring

⁷⁵ The project is co-financed from ESF, <https://ec.europa.eu/esf/main.jsp?catId=46&langId=en&projectId=3637>.

⁷⁶ The ‘blue’ sectors include coastal tourism, aquaculture, marine energy and biotechnology - <https://ec.europa.eu/esf/main.jsp?catId=46&langId=en&projectId=3637>.

⁷⁷ Young people not in employment, education or training (NEETs).

disadvantaged groups into employment and promoting at the same time the transition to greening the economy.

Box 4 provides the example of a small-scale employment incentive introduced recently in Slovenia. An additional example for a small-scale employment subsidy in place since 2010 in Bulgaria is presented in Annex Box C5.

Box 4. Employment incentive for green jobs

In **Slovenia**, in the context of government's strategy towards greening the economy, a new employment incentive called Green jobs has been introduced as a pilot measure, financed by the Ministry of Environment through the climate change fund. The target for 2021 is to include around 200 unemployed in this measure in order to be hired in green jobs. The employment subsidies amount to around 340 Euro per month (which is a quite high level when compared to other subsidies). It is be paid to employers in cases of hiring unemployed on a permanent employment contract and the subsidy will be paid for two years. The employers have to fulfil some criteria to receive the subsidies in addition to the usual criteria. These additional criteria are related to occupations, sectors, any certificates connected to the green jobs/sector/activity (activities, products that are in line with climate and environmental goals, according to the Ministry of Environment, obtained standards and certificates - ISO 14001, eco-label EMAS, and others).

Source: interview with the Slovenian PES.

Employment incentives may be used for occupations for which a shortage exists. Box 5 shows the example of such a measure in Sweden. The example also shows the involvement of a variety of actors.

Box 5. Green jobs for nature in Sweden

The Green jobs initiative in 2020 for people who are far from the labour market was aimed at alleviating unemployment linked to the ongoing outbreak of COVID-19. It offered unemployed people training in occupations in the green industries where there were shortages, and at the same time promoted outdoor activities, cultural sites, recreation, and tourism. The initiative covered the entire country and during the autumn 2020, 608 placements were planned for people far from the labour market. The Swedish Forest Agency, the Geological Survey of Sweden, the Swedish Environmental Protection Agency, the county administrative boards and the Swedish Public Employment Service are the agencies involved in implementation of this initiative.

Source: <https://www.government.se/press-releases/2020/07/green-jobs-for-nature-across-the-country/>.

Good practices include measures for disadvantaged groups in job creation and public works programmes

Past experience with job creation programmes shows that job creation measures have usually focused on socially and environmentally useful projects, but in niches, so that they do not compete with existing activities and services. ALMPs for greening the economy will certainly have to leave this 'niche' and additional character and become part of promoting transition towards employment in the regular labour market. A number of practices can be found for initiatives in this tradition of creating additional employment (see for an example from Slovenia in Annex Box C6). National and European funding has been used to support projects to integrate disadvantaged groups in the labour market. The advantage of using ESF funds is that it allows for social innovations. However, a challenge when using ESF funds for this type of activities is that measures may remain unique and may not be continued over time. For an ambitious green transition, this type of measure may need to become structural, meaning that innovative approaches and ALMP budgets need to be taken over in mainstream ALMP.

There is potential for social enterprises and cooperatives to support projects for a green transition, as the example of the 'Local actions for the social inclusion of vulnerable groups in the Municipality of Fyli' project⁷⁸ in Greece shows. The project provided support to unemployed people from disadvantaged social groups (the long-term unemployed over 45 years old, people in poverty, heads of single-parent families) so that they could establish their own businesses concerned with activities to regenerate public spaces. Another example is a project designed to bring people with disabilities into work in France (see Annex Box C7). Also in this example, the partnership approach has been decisive.

Box 6 shows how labour market integration of marginalised groups in labour markets in Central, Eastern and South-eastern MSs as well as the Western Balkans can work. Also, this example is based on a partnership approach.

Box 6. 'Work Locally Develops Globally — but Green!' - Bulgaria, Czech Republic, Croatia, North Macedonia and Slovenia

The project implemented (2014-2015) under the EU EaSI Programme was aimed at improving the chances of employment and skills of local Roma populations in three cities and at enabling people to work with waste collection, recycling and independently run their businesses. Five countries participated in this project: Bulgaria, Czech Republic, Croatia, North Macedonia and Slovenia, while the target groups consisted of national, regional and local authorities, NGOs, higher education institutions and research institutes.

The initiative was led by a Roma-run municipality in Europe⁷⁹ and encouraged the sharing of good practices between Macedonian Roma entrepreneurs and counterparts from neighbouring countries, with the main goal of improving the skills of the local Roma populations by encouraging informal green businesses to become formal.

In the framework of the project, green business incubators have been launched in three cities in Bulgaria, North Macedonia and in Slovenia, and a network of Green Business Incubators was established to support future green business start-ups.

Over 260 people participated in the peer learning and training events, while the 28 communication events aimed mostly at the target group and organised in the partner countries reached an audience of 830 people⁸⁰.

Source: <https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=7966&furtherPubs=yes>

Partnerships

As shown in the examples above, designing and implementing measures in a partnership approach can potentially improve the effectiveness and efficiency of the measures. The French PES is striving towards setting up 'strategic partnerships', covering different fields of activities, ranging from skills anticipation to implementation of training (see box in the annex C8). This approach could also be relevant for other PES.

⁷⁸ <https://ec.europa.eu/esf/main.jsp?catId=46&langId=en&projectId=2199>.

⁷⁹ Shuto Orizari - located on the outskirts of the capital Skopje - <https://www.euronews.com/2018/07/05/only-district-in-europe-roma-are-majority>.

⁸⁰ <https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=7966&furtherPubs=yes>.

7. CONCLUSIONS: THE WAY FORWARD FOR PUBLIC EMPLOYMENT SERVICES

There are high expectations from policy makers and key stakeholders to accompany and smooth the transition towards greening the economy. It is generally perceived that the ecological transition is feasible if the skills of workers are adapted accordingly. PES are one of the key actors in this process.

PES can build on a range of measures they already have in place to manage ongoing restructuring. However, new challenges appear: complexity increases, as greening of the economy and greening of skills needs to be transversal. This is likely to have an impact on the taxonomy of occupational profiles PES use as well as on PES upskilling activities. Existing trends like digitalisation will also become highly relevant for the greening of the labour market, and this is likely to affect all skill levels, pointing to the need to invest in digital skills and close the skills gap.

An ambitious ecological transition will call for a shift in the focus of PES activities towards skills profiling, identifying transferable skills, vocational guidance, upskilling and retraining measures at all skill levels. It is recommended to work in close cooperation with employers, sector associations, training institutions, universities and research centres in order to grasp the type of skills adaptation needed in specific occupations and specific sectors in a given local labour market context. Training measures are already in effect among the key ALMPs.

As in the past, the PES will also need to have other active labour market programmes in place targeted at those who cannot be upskilled or reskilled. Direct job creation measures and public works with a social and ecological objective offer the possibility to integrate vulnerable groups into the growing regular labour markets of a circular and environmental protection labour market. There is potential for growing the green labour market to offer opportunities for disadvantaged groups to take up regular employment within the green economy.

On the basis of the above analysis and linked to the typologies developed in section 5 which show the need for differentiated strategies for local labour markets and different labour market segments, the recommendations for the way forward include the following issues and are addressed to PES in the first place. Some of the recommendations are general, others refer to activities in specific transition patterns. PES need to select those initiatives that fit their labour market (thus depending on typology).

Understanding skills requirements and the labour market dynamics of the green transition

- Improve the knowledge base on skills and career transitions on the way towards a green economy, and make use of the knowledge base.
 - PES should be involved in sector skills alliances related to the greening of the economy and labour markets.
 - Conduct research or contribute to identifying 'green skills' and 'green occupations', for example by introducing relevant questions into vacancy and skills surveys sent to employers.
 - Cooperate with skills observatories.
 - Use labour market information systems produced by other actors (education research, agencies for ecological transition, environmental protection, sector skills councils, etc.).
- Develop further skills and competence-based profiling techniques and guidance for adults to promote their career management in a context of greening labour markets.

- Partnerships with local level actors (employers, chambers, associations, civil society etc) to identify local challenges and employment potentials.
- At EU level: the PES Network should step up co-operation and exchange within the network and engage in a stronger co-operation with ESCO to improve and share knowledge about green taxonomies and occupational classifications.

Skills development

- Provide vocational guidance to girls and young women in such a way as to motivate them to enrol more in STEM study fields, possibly with a specialisation in green skills (like climate, energy and environmental engineering).
- Promote skills adaptation in the light of required retraining on the basis of acquired skills and experience. Skills adaptation, upskilling and reskilling will also become relevant for older workers.
- Continue the development of schemes for validation of prior learning and upskill, if necessary, to obtain certified skills; establish an overview of certificates related to the acquisition of 'green skills'.
- Provide information on training offers in the area of green generic and technical skills and increase transparency of training offers.
- Financially support short- and long-term training measures to acquire the required generic and transversal skills, as far as this complies with PES responsibilities. Since training measures are costly, PES would have to clearly communicate to the relevant ministries the need to foresee sufficient national budget for the transition towards greening labour markets.

Employment incentives and start-ups

- Link employment incentives to activities within the national defined sustainable energy, climate-friendly and circular economy strategies and explore with local stakeholders employment opportunities.
- Link, when relevant, ALMPs to the promotion of specific 'green sectors', and green transformation of specific industries at the local level. This requires a partnership approach at the local level. In this sense, PES can become one of the actors for a bottom-up ecological transition.
- Link training measures and employment incentives, provide on-the-job training, in particular for disadvantaged groups.
- Target employment incentives at disadvantaged and vulnerable groups.
- Promote start-ups, such as for organic farming and eco-tourism in rural areas.

Placement

- Improving matching by using technology (semantic search 'green' etc.) and improving the skills taxonomy.
- Cooperate with private employment services to increase the transparency of green and greening jobs offers.
- Actively collect vacancies in the area of the green economy and cooperate with employers, employer federations and chambers to increase the visibility of the PES.

Employer services

- Provide counselling, in particular to SMEs in the area of human resource management (recruitment, skills identification, skills development in the context of

greening the activities of the company, certification and validation of green skills and transversal skills that are useful for greening the economy).

- As far as it fits to the responsibilities and legal framework of the PES, implement preventive policies by providing support to upskilling workers for acquiring 'green skills' in sectors particularly affected by the ecological transition, for SMEs and micro enterprises, for upskilling low-skilled and medium-skilled workers in unstable working conditions.

Income support measures

- Income support measures, such as unemployment benefits, are key to allowing an efficient transition towards greening labour markets. This will be challenging as it may increase the resources needed to pay unemployment benefits. In addition, financial resources may be needed to promote geographical mobility of jobseekers.

Awareness-raising activities

- Implement awareness-raising activities within PES, and train staff.
- Participate in local mainstreaming and information campaigns on green and greening jobs.
- Cooperate with local stakeholders for economic development to increase attractiveness, of among other things rural areas, in order to retain workforce.

Engage in partnerships

- Engage in a regular exchange with employers, sector associations, researchers and other relevant stakeholders on labour market trends, in particular on greening jobs and skills and challenges linked to the ecological transition.
- Offer a comprehensive approach for placement measures, training measures, employment incentives and guidance in case of large-scale dismissals engendered by the ecological transition. PES and private employment agencies as well as NGOs should take a partnership approach and cooperate with social partners.
- Partnerships at local level can help in levelling the outreach, targeting measures and building a sound knowledge base.

Human capital and social investments

- PES should make sure the national governments are aware that managing labour market transitions engendered by the ecological transition requires additional investments in occupational research and skills anticipation, skills development, income replacement and job creation measures for the most vulnerable groups, in order to leave no-one behind.
- Depending on the speed of the ecological transition, and the type of greening labour market, this may require additional budgets for ALMPs.
- There is also a need to increase the capacity of many PES, in relation to their staff capacities, as accompanying occupational transition is likely to be staff intensive, as well as for improving their labour market information systems.

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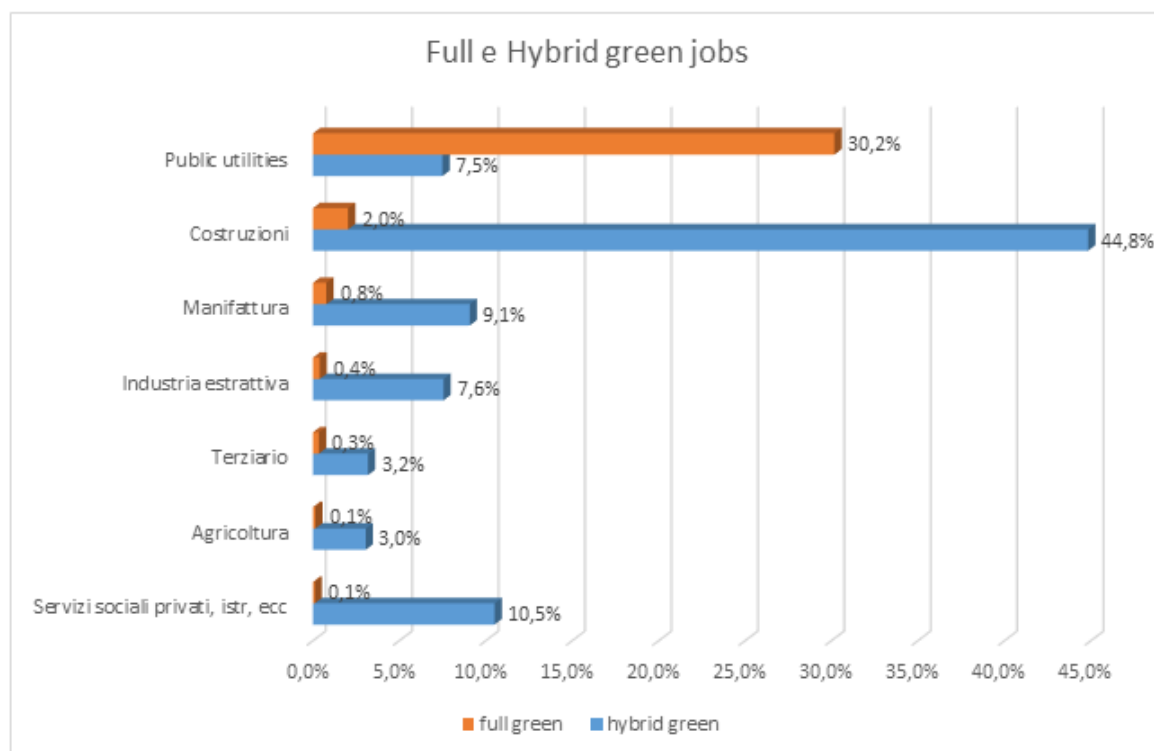
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ANNEXES

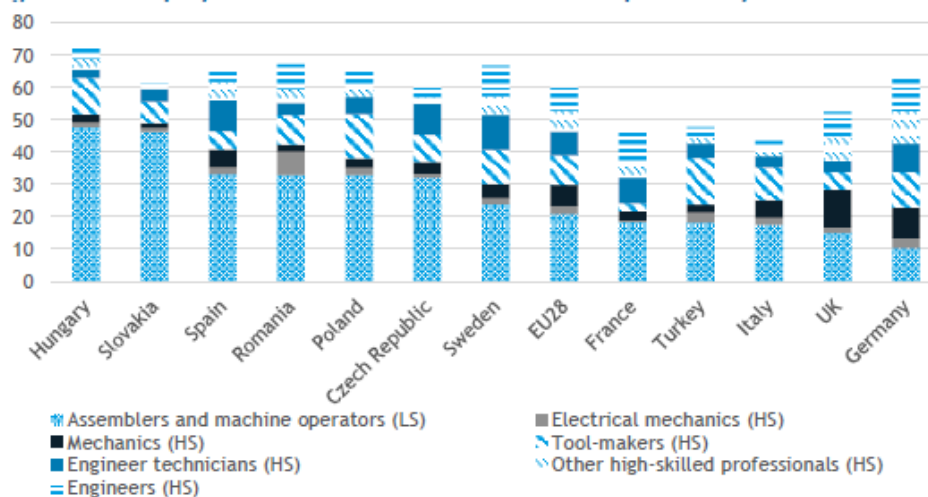
Figure A1 Full and hybrid green jobs in Italy



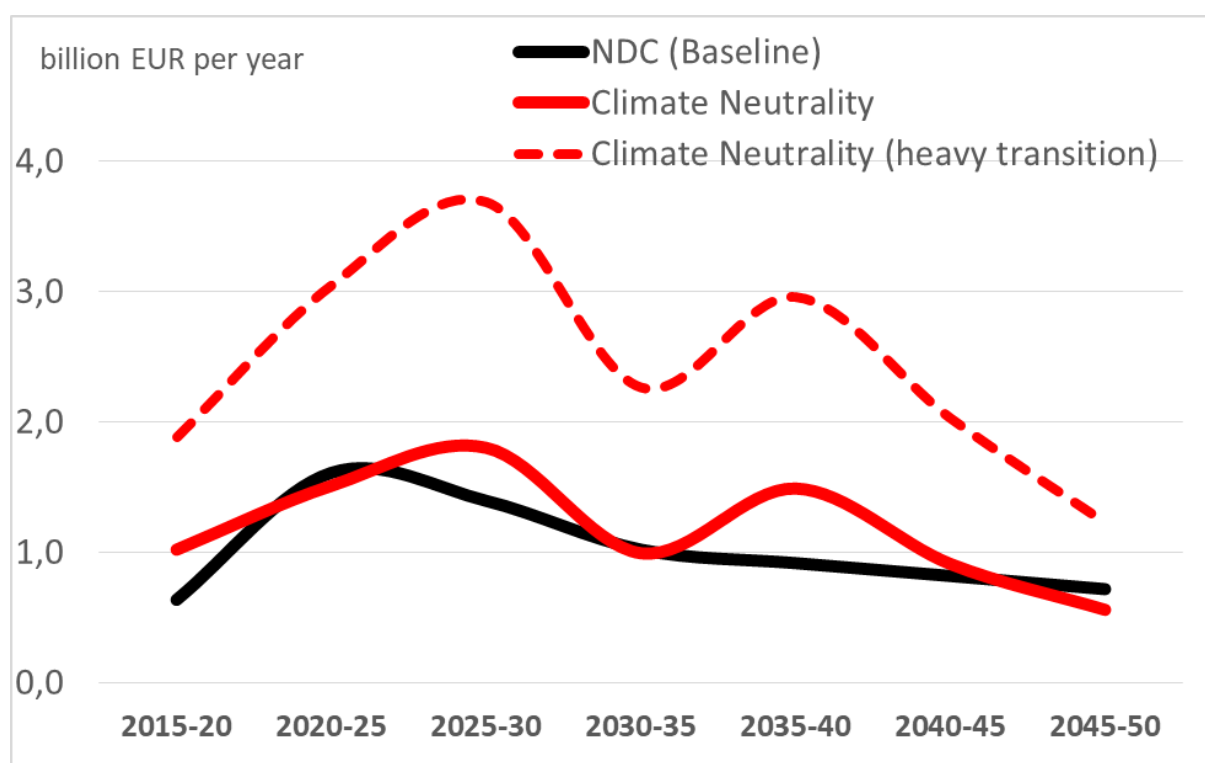
Source: INAPP

Figure A2 Employment by skills in the automotive industry

Figure 6-11: Employment shares in the automotive sector per country

Source: Cambridge Econometrics, Element Energy & Ricardo-AEA, 2013, *Fuelling Europe's Future*

Source: Cambridge Econometrics et al., 2018

Figure A3 Annual cost for income replacement and training, EU-27 plus UK

Source: European Commission ESDE 2020, based on JRC-GEM-E3 (European Commission).

Table A1: Just Transition Fund - Preliminary territorial eligibility and key actions*

Just Transition Fund - Preliminary territorial eligibility and key actions *												
EU MS	Regions severely affected by the green transition	Sectors/industries affected by the green transition	Key actions of the Just Transition Fund could target in particular:									
			Productive investments in SMEs, including start-ups, leading to economic diversification	Investments in the creation of new firms, including through business incubators and	Investments in research and innovation activities and fostering the transfer of	Investments in regeneration and decontamination of sites, land restoration and	Investments in the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy	Investments in enhancing the circular economy, including through waste prevention, reduction, resource efficiency, reuse, repair	Investments in digitalisation	Upskilling and reskilling of workers	Job-search assistance to jobseekers	Active inclusion of jobseekers
AT	Östliche Obersteiermark, Traunviertel	Carbon-intensive industries, e.g. the manufacture of basic metals, paper and paper products, chemicals and chemical products	X	X	X	X	X	X	X	X		
BE	Tournai, Mons, Charleroi	Production of cement, chemicals and electricity	X		X	X	X	X	X	X		
BG	Maritsa, Bobov Dol	Coal mining and coal-fired power production	X		X	X	X	X	X	X	X	X
CY	Vassilikos, Dhekelia	Electricity production			X		X			X	X	
CZ	Moravskoslezsky, Ústecký, Karlovarský	Coal mining and coal-fired energy sector	X	X	X	X	X	X	X	X	X	X
DE	Elbe-Elster, Oberspreewald-Lausitz, Dahme-Spreewald, Spree-Neiße, Cottbus, Bautzen, Görlitz, Leipzig, the City of Leipzig, Nordsachsen, Burgenlandkreis, Saalekreis, the City of Halle, Mansfeld-Südharz, Anhalt-Bitterfeld, Dören, Rhein-Kreis Neuss, Rhein-Erft	Coal mining for electricity generation	X	X	X	X	X	X	X	X	X	X
DK	Northern Jutland	Cement industry	X	X	X		X	X		X		
EE	Northeastern	Oil shale sector	X	X	X	X	X	X	X	X	X	X
EL	Kozani, Kastoria, Florina (Western Macedonia), Megalopolis, Heraklion, Lassithi, Rethimno, Chania (Crete) and Aegean Islands (Lesvos, Samos, Chios, Rhodes, Mykonos)	Coal/lignite sector, heavy oil and diesel-fired production	X			X	X			X	X	X
ES	Asturias, León, Palencia, Cádiz, A Coruña, Córdoba, Almería, and Teruel	Coal-mining sector, coal-fired power production	X	X	X	X	X	X	X	X	X	X
FI	Etelä-Savo, Pohjois-Savo, Pohjois-Karjala, Kainuu, Keski-Pohjanmaa, Pohjois-Pohjanmaa, Lappi	Peat production	X	X	X	X	X			X		
FR	Nord, Bouches-du-Rhône	Energy, chemical and steel industries		X	X		X			X		
HR	Sisak-Moslavina, Istria	Chemical industries and refined petroleum production, electricity production from coal and cement industry	X		X		X	X	X	X		
HU	Heves, Baranya	Coal mining/fossil fuel production			X	X	X	X		X	X	X
IE	Midland	Peat burning power production	X	X	X		X	X		X	X	
IT	Taranto, Sulcis-Iglesiente	Coal mining, coal-fired power production and iron/steel production	X	X		X	X	X		X	X	X
LU	Esch sur Azette, Rumelange	Cement and steel industries	X		X		X			X		
LT	Kaunas, Telsiai, Siauliai	Highly Greenhouse Gas Emissions (GHG)-intensive industrial installations	X	X	X		X	X		X		
LV	Vidzeme, Latgale	Peat extraction/wetlands	X	X	X	X	X			X		
MT	Grand Harbour Port, FreePort	Transport, building (including the use of fluorinated gases)			X		X	X		X		
NL	East Groningen, Delfzijl, surroundings and rest of Groningen	Emission-intensive industries			X		X			X		
PL	Silesia: Katowice, Bielsko-Biala, Tychy, Rybnik, Gliwice, Bytom, Sosnowiec, Konin	Coal mining	X	X	X	X	X	X		X	X	X
PT	Alentejo Litoral, Médio Tejo, "Concelho" of Matosinhos	Coal-fired power production, manufacture of refined petroleum products and plastics	X	X	X	X	X	X		X	X	X
RO	Hunedoara, Gorj, Dolj, Galați, Prahova and Mureș	Coal mining and coal-fired power production, heavy industry (chemicals, metal processing cement, fertilisers, etc.)	X	X	X	X	X	X	X	X	X	X
SE	Norrbotnen, Västerbotten	Industries using fossil fuel, steel industry	X	X	X		X	X		X		
SI	Zavaska, Savinjska	Coal mining	X		X	X	X	X	X	X	X	
SK	Trencin, Kosice	Coal mining, coal-fired power production and steel production		X	X	X	X	X	X	X		X

*Information extracted from "European Semester 2020 - Overview of Investment guidance on the Just Transition Fund (JTF) per Member States (Annex D)". The Annex D contains preliminary Commission services' views on priority investment areas and framework conditions for effective delivery for the 2021-2027 Just Transition Fund investments in EU MS. These priority investment areas are derived from the broader analysis of territories facing serious socio-economic challenges in the transition process towards a climate-neutral economy of the Union by 2050. The Annex D also provides a basis for a dialogue between MS and the Commission services and relevant guidance for the MS in preparing their Territorial Just Transition Plans (still under preparation at the moment of developing the current report) - https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2354; <https://ec.europa.eu/info/files/2020-european-semester-overview-investment-guidance-just-transition-fund->

*Information extracted from 'European Semester 2020 - Overview of Investment guidance on the Just Transition Fund (JTF) per Member States (Annex D)'. The Annex D contains preliminary Commission services' views on priority investment areas and framework conditions for effective delivery for the 2021-2027 Just Transition Fund investments in EU MS. These priority investment areas are derived from the broader analysis of territories facing serious socio-economic challenges in the transition process towards a climate-neutral economy of the Union by 2050. The Annex D also provides a basis for a dialogue between MS and the Commission services and relevant guidance for the MS in preparing their Territorial Just Transition Plans (still under preparation at the moment of developing the current report) - https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2354; https://ec.europa.eu/info/files/2020-european-semester-overview-investment-guidance-just-transition-fund-2021-2027-member-state-annex-d_en

B: List

B1: Occupations in demand for activities related to the circular economy in Spain

The experts consulted when compiling the prospective study on the circular economy in Spain indicate the following occupations and tasks in demand within key occupational groups (SEPE 2020).

(i) Directors and managers to be employed in waste management companies, design departments and quality control departments.

(ii) Scientific and intellectual technicians, in particular environmental staff (including occupational and environmental health and hygiene staff, environmental protection staff and environmental education staff), engineers and technical engineers (environmental, research & development, maintenance and repair, automotive mechanics, industrial and production design, logistics); chemists, biologists, geologists and geophysicists.

(iii) Technicians and support staff (automotive technicians, automotive mechanics technicians, automotive electrical technicians, mechanical maintenance technicians, electrical equipment maintenance technicians); computer systems, electronics, automation, and robotics technicians (IT systems operations technicians; computerised manufacturing plant operators; industrial robot programmers and controllers; general automated assembly line operators; industrial robot operators in general; digital-control machine programmers in general); waste water and solid waste treatment technicians (solid waste treatment technicians, wastewater treatment plant operators, environmental technicians, wastewater treatment plant technicians, urban solid waste treatment plant operators; waste incineration plant maintenance operators.

(iv) Craftsmen and skilled workers in manufacturing industries such as automotive mechanics, fitters and repairers (motor vehicle mechanics and fitters, electronic equipment mechanics and repairers, electrical equipment mechanics and repairers, vehicle painters in general); skilled industrial workers (sheet metal workers and boilermakers, welders and flame cutters, machine tool setters and operators, refrigeration and air-conditioning mechanics-installers, agricultural and industrial machinery mechanics and fitters), ICT installers and repairers.

(v) Plant and machinery operators and assemblers such as truck drivers.

(vi) Elementary occupations such as waste sorters & recycling centre operators, and scrap metal collectors, rubbish collection workers, drain maintenance workers, street sweepers.

C. Additional examples of good practice

Box C1. Identifying potential for occupational mobility at local level in France

In 2015 in France, the Ministry for Ecological Transition and the labour ministry supported the development of a toolkit for promoting ecological transition. The development of the toolkit was based on local experiments in three regions. One of the tools consists in identifying occupations at risk in the context of economic restructuring and 'green' or 'greening' occupations in the local area. One of the experimental local areas was Molsheim Strasbourg South. Five occupations at risk were identified in this industrialised area⁸¹. Eight green or greening occupations have been identified within the PES occupational classification system⁸². A description of the tasks, qualifications and competences are provided through occupational profiles prepared by the French PES and current and future employment prospects in the different industries in the regional labour market are shown.

These descriptions served as a basis to identify eight pathways to occupational transition:

(1) From laboratory technician in chemical industries to manufacturing technician in chemistry; (2) from metal production operator to boilermaker; (3) from industrial maintenance agent to sanitation technician, (4) from operator on mechanical production machine to mechanical fitter, (5) from adjuster to service technician in cooling and air conditioning, (6) from metal production operator to pipeline, (7) from industrial maintenance agent to pipefitter, (8) from regulator to industrial waste treatment agent.

For each transition a comparison of tasks, common competences and differences in required skills, and wage levels are provided as well as information on the qualifications required. It is stated whether the new occupation can be trained in the region/local area. The details of upskilling possibilities are left open, as they need to be designed and decided on a case-by-case basis (depending on the diploma already obtained and on experience). For each occupational transition an overall assessment of whether the transition is easy is provided.

The toolkit also contains the example of other analysed occupational transitions in other local labour markets, applying the same methodology.

Source: MEDDE, MFTEFPD (2015), Accompagnement des transitions professionnelles des filières industrielles impactées par la transition écologique et énergétique, Les Annexes au kit méthodologique, prepared by Katalyse, Opus 3, <https://www.ecologie.gouv.fr/laccompagnement-des-transitions-professionnelles>.

Box C2. The 'employ green' (Empleaverde) programme in Spain

The 'employ green' Empleaverde programme in Spain⁸³ is an initiative of the Biodiversity Foundation, created in 2007, to promote and improve employment, entrepreneurship and the environment. The programme is led by the Ministry for Ecological Transition and the Demographic Challenge and was co-financed by the European Social Fund (ESF) within the framework of the 2014-2020 Employment, Training, and Education Operational Programme. The programme is still running. The programme aims to create jobs, improve employability and support business creation in the green and blue economy, with special emphasis on an economy linked to nature conservation and the circular economy, while being low in carbon. This includes ecological agriculture and livestock, wastewater treatment and purification, waste management and treatment, production of renewable energy, management of protected natural areas and forest areas, environmental services to companies and entities, and education and environmental information, as well as new opportunities offered by information and communication technologies, sustainable tourism, specific activities related to mitigation or adaptation to climate change, and investment in the protection and

⁸¹ Industrial maintenance agent, metal production operator, adjuster, laboratory technician, operator on mechanical production machine.

⁸² Chemical manufacturing technician, boiler, sanitation technician, mechanic fitter, cold and air conditioning intervention technician, channel, pipe, industrial waste treatment agent.

⁸³ <https://www.empleaverde.es/programa-empleaverde>.

restoration of nature. Special attention was paid to helping workers in declining economic sectors re-skill for the green jobs market.

The Empleaverde programme planned to support more than 50 000 people and 3 000 companies.⁸⁴ A number of activities have been carried out, including the setting up of a network and mentoring for business start-ups.⁸⁵ New calls were launched in summer 2020⁸⁶: The 'Employment/Emplea Call' aimed to support the hiring of unemployed people in the green and blue economy. It includes subsidies (between EUR 1 900 and 3 440 per contract performed/concluded) for hiring unemployed people. Private entities, for-profits or non-profits based in Spain, and self-employed persons acting in the green and/or blue economy and who hire or have hired unemployed people full time for a minimum period of 6 months can apply for these subsidies. The 'Improvement/Mejora Call' aims to support training and advice projects on issues related to the green⁸⁷ and blue⁸⁸ economy. Priority groups for these measures are women, young people up to 35 years of age, those over 45, immigrants, people with disabilities and residents in protected areas and / or rural areas.

Box C3. Training needs assessment by the Spanish PES

As part of its training needs prospecting and detection work, the SEPE Occupations Observatory and its network reported on changes occurring in economic activities and occupations to anticipate and respond to the challenges and requirements in labour market demands. To achieve this, each year, the Observatory prepares and publishes the *Training Needs Survey and Detection Report 2020* as a starting point and reference for developing training provision that can best respond to gaps and changes in the labour market. The report identifies the technical-professional, and cross-cutting needs of each of the occupations studied, grouped into occupational categories. The SEPE Observatory also produces reports on occupations published on the National Public Employment Service's website, www.sepe.es. It includes training needs linked to the circular economy. The information about each occupational category includes: (i) training needs in technical and professional skills and (ii) training needs in industry-wide and generic (soft) skills. The labour market situation, experience requirements, difficulty or otherwise in filling vacancies, functional mobility, and entrepreneurship possibilities. As with the presentation of training needs by occupational category, the information in the individual records is structured by training needs in technical-professional skills, cross-cutting skills, economic activities where these occupations are being hired, their situation in the labour market, and their geographical distribution. The mentioned study by the PES occupational observatory also contains an inventory of certificates, VET training and university studies, as well as continuing training at company level for occupations which are relevant for the activities of the circular economy (SEPE 2020).

⁸⁴ It had the objective to achieve the following results <https://www.empleaverde.es/programa-empleaverde>

⁸⁵ <https://www.redemprenderverde.es/pg/pages/view/106/%C2%BFQu%C3%A9%20es?/>.

⁸⁶ <https://www.miteco.gob.es/es/prensa/ultimas-noticias/el-ministerio-para-la-transici%C3%B3n-ecol%C3%B3gica-y-el-reto-demogr%C3%A1fico-convoca-ayudas-por-107-millones-para-la-creaci%C3%B3n-de-empleo-verde/tcm:30-513893>.

⁸⁷ Green economy - contributes to the emergence of new models of sustainable production and consumption, generating in turn social and environmental benefits in the territory and favouring the creation of new jobs - <https://www.empleaverde.es/en/empleaverde-program>.

⁸⁸ Blue economy - refers to an economy based on the sustainable development of the oceans. It contributes to international competitiveness, efficiency in the use of resources, job creation and the birth of new sources of growth, safeguarding biodiversity - <https://www.empleaverde.es/en/empleaverde-program>.

Box C4. Programme for 10 000 training courses in ecological transition jobs in France

In May 2018, the French ministry of ecological transition and solidarity and the ministry of labour launched the initiative '10 000 training courses in ecological transition jobs.' This initiative is part of the Competences Investment Plan (*Plan d'investissement dans les compétences*).

The investment plan will also co-finance the management of human resource and skills anticipation activities (GPEC⁸⁹) of the sectors, to better identify new needs and have more precise and operational analyses of the new skills expected. Projects are underway in the following sectors: building (French Building Federation), public works (national federation of public works), logistics, waste recovery, recycling. The skills concerned are in particular: waste sorting for professional activities and clean sites and the circular economy; use of more environmentally friendly products, use of bio-materials in construction ; care, maintenance and recycling in the automotive sector; farmers who are embarking on the methanisation of biomass; installation of new high-performance equipment: condensing boilers, heat pumps, smart metering tools; new actions by diggers, to preserve biodiversity or save non-renewable materials.

Another activity consists in adapting the reference documents of trades and certifications, which are in some cases ten years old. As a result, the professional title of project manager in energy renovation in construction, has just been created, while the title of maintenance technician in heating, air conditioning and renewable energy equipment has been significantly revised.

Source: Press release of the Ministry for ecological transition and solidarity and the Ministry of labour, (Ministère d'Etat, Ministère de la Transition écologique et solidaire, Ministère du travail), 14 May 2018, <https://www.pole-emploi.org/accueil/communiqués/lancement-des-10-000--formations.html?type=article>.

Box C5. Employment subsidies to hire unemployed in 'green jobs', Bulgaria

An active labour market measure for the creation of green jobs was introduced in Bulgaria in 2010. In line with the law in place, 'green' jobs are those which are launched in economic activities related to production of goods and provision of services supporting the environment, according to a list of economic activities⁹⁰ updated and approved each year by the Minister of the Environment and Water and the Minister of Labour and Social Policy. The candidate for a green job has to be an unemployed person, with at least six months registration with local employment agencies. Simultaneously, employers wishing to access the subsidy have to show that the occupations in which the unemployed will be employed are in eco-industries and services. The employment subsidy (500 BGN – around 255 Euro) is paid from the state budget for a maximum period of 6 months for employees with a third degree of vocational qualifications, or 8 months, and for employees with higher education. All information, eligibility criteria and application documents or documents to be completed to subsidise new green jobs are available on the Bulgarian PES website⁹¹. However, the number of participants was low.

Source: Ministry of Labour and Social Policy Bulgaria (2017), 'Elaboration of a subsequent assessment of the effect of the active labour market policy financed by state budget resources at individual level (net effect)', <https://www.mlsp.government.bg/uploads/26/zaetost/final-report-print-en.pdf>

⁸⁹ Gestion prévisionnelle de l'emploi et des compétences.

⁹⁰ <https://www.az.government.bg/pages/myarka-naemane-na-bezrabotni-lica-s-neprekasnato-poddarzhana-registraci-q-nad-6-mesece-na-zeleni-rabotni-mesta/>.

⁹¹ <https://www.az.government.bg/pages/myarka-naemane-na-bezrabotni-lica-s-neprekasnato-poddarzhana-registraci-q-nad-6-mesece-na-zeleni-rabotni-mesta/>.

Box C6. 'USE-REUSE' - Good for jobs, good for the environment... Slovenia

The project 'USE-REUSE'⁹², implemented by the Environmental Research Institute (2010 – 2014), provided various practical and motivational workshops to 12 hard-to-employ and disadvantaged unemployed women. Six women (out of the 12 participating in training) have been offered green jobs in the 'Use-Reuse' centres, aimed at reducing the amount of rubbish destined for landfill. The project was co-financed by the Slovenian Ministry of Labour, Family, Social Affairs and Equal Opportunities and the European Social Fund. A USE-REUSE network was established running six REUSE centres across the country, which take in unwanted but viable products before selling them on as second-hand goods. The network has also registered as a brand – 'REUSE Centres' – that helps to raise awareness and get more people to use the facilities. The centres are qualified as social enterprises⁹³. Some of them, such as the REUSE centre in Rogaška Slatina also offer practical services for households and citizens who can repair usable products there. They repaint, sew, or restore a variety of products.

Box C7. 'Green economy – supporting the sustainable employment of older workers and people with disabilities', France

The project 'green economy – supporting the sustainable employment of older workers and people with disabilities'⁹⁴, funded under the EU EaSI Programme, was coordinated by the French PES, and implemented between 2013 and 2015. It was aimed at setting up a pilot partnership to secure career paths and employability for people with more difficulties in finding work, in the sector 'Water, Sanitation, Waste and Air' within the Rhône-Alpes region.

Different activities were carried out within the framework of the project, such as: development of a partnership strategy (between nine project partners and three future partners after the completion of the project)⁹⁵; diagnosis of regional sector-specific employment opportunities; development and implementation of an integrated and comprehensive support system for job-seekers and companies within the sector (including the survey of employers and training paths, easy-to-read and understand brochures, sectoral booklets, an e-learning platform); development of a sectoral communication plan; evaluation of the developed system.

Three training and mutual learning sessions were organised for 110 participants. As a result, 54 jobseekers were placed in work and 24 people were placed in training⁹⁶.

⁹² <https://ec.europa.eu/esf/main.jsp?catId=46&langId=en&projectId=1305> ; <http://www.eko-tce.eu/cpu-old/kaj-je-cpu>.

⁹³ <https://www.cpu-reuse.com/cpu/centri-ponovne-uporabe>.

⁹⁴ 'Economie verte – Un levier pour un emploi durable des personnes handicapées et des seniors', <https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8001&furtherPubs=yes>.

⁹⁵ ADEME (Agency for the Environment and Energy Management), AGEFIPH, Rhône-Alpes (Association for the Management of the Integration of Persons with Disabilities), Direccte, Rhône-Alpes (Regional Directorate for Enterprises, Competition, Consumer Affairs, Labour and Employment), FEDEREC (Federations of Recycling Companies), IEP Grenoble (Institute of Political Studies), Melèze-ELISE Lyon; NAEVA-ELISE; Region Rhône-Alpes - <https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8001&furtherPubs=yes>.

⁹⁶ <https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8001&furtherPubs=yes>.

Box C8. The French PES Pôle emploi: Strategic partnerships

Pôle emploi supports the development of the 'green' dimension of the economy by developing a policy of strategic partnerships. Partnerships are formed around different subjects and with different partners:

- Partnership with institutional actors: via exchange of information and data and identification of needs
- Competitiveness groups, scientific clusters and large companies: adapting and improving their range of services
- Professional branches and skills companies: ensuring transparency in the labour market.
- A partnership between the public and private sectors
- National Operators - OPCO -accompanying professional careers through training, VET
- Sectoral Kits Workshops: to raise awareness and highlight professional sectors in particular: water, air, waste, waste management, sanitation, sustainable construction, construction, transport and logistics, food chain).

Source: Pôle emploi 2021

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