



European Expert Network  
on Economics of Education

# The green transition in the labour market: how to ensure equal access to green skills across education and training systems

*Analytical Report*

### **Getting in touch with the EU**

Europe Direct is a service that answers your questions about the European Union.

You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11  
(certain operators may charge for these calls),
- at the following standard number: +32 22999696 or
- by email via: [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)

Luxembourg: Publications Office of the European Union, 2023

© European Union, 2023

Reuse is authorised provided the source is acknowledged.

The reuse policy of European Commission documents is regulated by Decision 2011/833/EU (OJ L 330, 14.12.2011, p. 39).

The information and views set out in this report are those of the authors and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this study. Neither the Commission nor any person acting on the Commission's behalf may be held responsible for the use which may be made of the information contained therein.

For any use or reproduction of photos or other material that is not under the EU copyright, permission must be sought directly from the copyright holders.

# **The green transition in the labour market: how to ensure equal access to green skills across education and training systems**

## ***Analytical Report***

Barbara Janta, Eliza Kritikos and Thibault Clack

**Please cite this publication as:**

Janta, B., Kritikos, E. and Clack, T. (2023). 'The green transition in the labour market: how to ensure equal access to green skills across education and training systems', *EENEE Analytical report*. doi: 10.2766/563345.

**ABOUT EENEE**

EENEE is an advisory network of experts working on economics of education and training. The establishment of the network was initiated by the European Commission's Directorate-General for Education and Culture and is funded by the Erasmus+ Programme. PPMi is responsible for the coordination of the EENEE network. More information on EENEE and its deliverables can be found on the network's website [www.eenee.eu](http://www.eenee.eu). For any inquiries, please contact us at: [eenee@ppmi.lt](mailto:eenee@ppmi.lt).

**Contractor:**

Gedimino pr. 50, LT -  
01110 Vilnius, Lithuania  
Phone: +370 5 2620338  
E-mail: [info@ppmi.lt](mailto:info@ppmi.lt)  
[www.ppmi.lt](http://www.ppmi.lt)

**AUTHORS:**

**Barbara Janta**, RPA

**Eliza Kritikos**, RPA

**Thibault Clack**, RPA

**PEER REVIEWER:**

**Miroslav BEBLAVÝ**, EENEE Scientific Coordinator

**Simon McGrath**, University of Glasgow

**LANGUAGE EDITOR:**

**James Nixon**, Copyeditor/Proofreader

**EUROPEAN COMMISSION**

Directorate-General for Education, Youth, Sport and Culture  
Directorate A — Policy Strategy and Evaluation  
Unit A.4 — Evidence-Based Policy and Evaluation

E-mail: [eac-unite-a4@ec.europa.eu](mailto:eac-unite-a4@ec.europa.eu)

*European Commission  
B-1049 Brussels*

## Table of contents

<b>Table of contents .....</b>	<b>5</b>
<b>Executive summary .....</b>	<b>6</b>
<b>1. Introduction .....</b>	<b>8</b>
1.1. The EU policy context .....	8
1.2. Aims and research questions .....	8
1.3. Methodological approach .....	9
<b>2. Skills for the green transition .....</b>	<b>10</b>
2.1. Definitions of green(er) jobs and skills .....	10
2.2. Characteristics of green skills .....	13
2.3. Taxonomies and frameworks for green(er) jobs skills .....	15
2.3.1. European Commission taxonomy based on O*NET (EC, 2019b) .....	16
2.3.2. ESCO green skills classification methodology .....	17
2.3.3. GreenComp .....	17
2.3.4. Skills OVATE tool .....	17
2.3.5. Developments at national level .....	18
2.4. Prevalence of green(er) jobs and need for green(er) skills .....	18
<b>3. Access to and acquisition of green skills in IVET and LLL .....</b>	<b>20</b>
3.1. Key facilitators and obstacles .....	21
3.2. Societal dimensions that affect unequal access .....	22
3.3. Gender .....	23
3.4. Age .....	27
3.5. Skill levels and occupations .....	31
<b>4. Key findings, policy implications and recommendations .....</b>	<b>35</b>
4.1. Key findings and conclusions .....	35
4.2. Policy recommendations .....	36
<b>Annex A – Bibliography .....</b>	<b>39</b>
<b>References .....</b>	<b>39</b>
<b>Additional sources .....</b>	<b>41</b>

## Executive summary

This analytical report presents a review of **evidence regarding access to, and the process of acquiring, skills for the green economic transition across initial vocational education and training (IVET), as well as lifelong learning (LLL) opportunities for people already in the labour market.** The report focuses on groups in society that may be particularly affected by the greening of the economy. The policy context for this paper is provided by the EU's ambitions for the green transition. These are set out in a number of policy documents that highlight the importance of skills in achieving these green goals. The report focuses on three interlinked aspects: (1) it provides characteristics of green(er) jobs and skills; (2) it assesses the extent to which current education and training provisions ensure equal access to the acquisition of green(er) skills; and (3) it provides illustrative examples of practices adopted by Member States to create equal and just access to green(er) education and training opportunities.

The analysis and conclusions contained in this report are based on a targeted review of literature from international and European-level sources covering EU Member States and assessing the current and future (next decade) situation and trends in the labour market. A broad range of sources discussing green skills in general have been identified during this research project; however, a **relative scarcity of sources** must be noted **regarding the specific topic of access to green skills** across education and training provision.

The sources reviewed provide compelling evidence that labour markets are undergoing green transitions. This comes as wider economies move towards decarbonisation, thus requiring numerous sectors to become green(er). Overall, sources suggest that **green(er) jobs will require a combination of soft and technical skills, as well as cross-cutting competencies.** Until autumn 2022, there was no commonly adopted approach to defining and measuring green(er) jobs and skills at international, EU or national levels. Instead, various organisations and governmental agencies formulated and adopted their own definitions and approaches. This lack of a commonly accepted definition of and approaches to measuring green(er) jobs and skills **made it challenging to form comparisons between jurisdictions. The new definition of 'skills for the green transition', developed jointly by the Inter-Agency Working Group on Work-based Learning in autumn 2022, focuses on technical and transversal skills.** The consistent adoption and application of this approach at international, EU and national levels would be a step in the direction of fostering greater definitional clarity and coherence, and would facilitate more targeted policy planning, implementation and evaluation, as well as enabling comparative analysis.

**Ongoing efforts are being made to systematically record and analyse green(er) skills** across the spectrum of jobs, in order to better understand trends and needs in employment and the labour market. To this end, several **frameworks and taxonomies have been developed** by stakeholders. However, there is **limited evidence** (research, and monitoring and evaluation data), **on how these developments are used in practice** to inform and transform the provision of education and training offers, as well as access to such provision. This is probably due to the fact that **these frameworks are still very new**, while updating/adopting curricula usually takes a long time.

Our review identified that **greening of the labour market will lead to some groups being particularly affected (both negatively and positively).** Gender, age and skills levels were found to be key determinants of potential social inequalities in securing green(er) employment opportunities. However, **disaggregating the impact of each of these social dimensions is challenging, due to the intersectionality of disadvantage(s).** The evidence reviewed indicates that male workers are transitioning into green(er) jobs at a faster rate than female workers, but that specific male-dominated sectors (such as fossil fuel extraction) are also particularly negatively affected by employment losses due to green economic transitions. Women are

also disadvantaged, as many green(er) employment opportunities require technical and managerial / leadership skills, and women are traditionally underrepresented in STEM-related occupations and leadership roles. The evidence also suggests that younger workers will probably benefit from the increase in green(er) jobs, due to their education including green components, as well as the fact that many programmes, particularly apprenticeships, are targeted at young(er) workers. Older workers may be at a disadvantage in acquiring green skills, as they are on average provided with fewer education and training opportunities. In addition, older workers were also found to face challenges resulting from their overrepresentation in sectors experiencing the negative impact of green economic transitions, such as fossil fuel extraction (coal in particular), and due to occupational and seniority downgrading when re-skilling. The evidence reviewed provides inconclusive findings with regard to the impact of the green transition on different skill levels. This is the result of different definitions of green(er) jobs and skills being adopted in studies, and from differing perspectives in looking at short-term vs. long-term impacts. Nevertheless, **an increase in overall employment levels is anticipated, with diffused impacts across all skills levels and occupations.** Consequently, evidence suggests that skills training and the provision of reskilling and upskilling programmes is required at all skills levels.

As noted above, our review found that the green transition will affect all spheres of society and that everybody will be impacted, but that **certain groups in society are already more negatively impacted than others (and will be in the future).** However, **policies** that could ensure equal access to green(er) jobs and skills **are still not being systematically, comprehensively and coherently applied across policy areas.** This often **results in disconnectedness between different policies and approaches aimed at the development of green(er) jobs and skills and addressing the impact the green transition has across society.**

The report concludes by providing a set of recommendations for EU and national-level policymakers. These are contextualised within the wider policy priorities relating to COVID-19 recovery measures and the current energy crisis. The paper includes recommendations to: (1) **consistent use of a common definition of green(er) jobs and skills across the EU Member States and internationally;** (2) **collect relevant social and economic indicators** (disaggregated along specific axes of potential inequalities) **to monitor trends in employment, education and training;** (3) **make better use of available resources, taxonomies and frameworks;** and (4) **ensure coordinated and coherent policy action** that takes into account the interrelationships between policy areas.

## **1. Introduction**

The green transition creates opportunities to adapt societies and economies so that they are based on environmental sustainability while ensuring inclusion for all. The literature emphasises that green(er) jobs require different skillset(s) and human capital from those required by non-green jobs. Consequently, the green transition can result in changes to the composition of the workforce and to the characteristics of workers. However, emerging evidence indicates that access to, and the process of acquiring, skills for green(er) jobs across education and training systems, as well as lifelong learning (LLL) opportunities, can be marked by disparities – and that these, in turn, could exacerbate societal and economic inequalities.

International organisations (e.g. the OECD, ILO, UNESCO), the European Commission and EU agencies (e.g. the European Centre for the Development of Vocational Training, Cedefop) have previously conducted research to identify the characteristics and types of green(er) jobs, and to assess supply and demand for green(er) jobs. To date, however, no systematic or succinct policy-oriented summary has yet been compiled of evidence regarding policies and practices aimed at delivering equitable conditions to the working population that needs to adapt in the greening economy, through initial vocational education and training (IVET) and LLL, including continuing VET (CVET), technical and vocational education and training (TVET). This short policy-oriented paper aims to address this gap in evidence synthesis.

### **1.1. The EU policy context**

The overall direction and measures needed for the green transition in Europe have been outlined in various EU-level policy documents, notably the European Green Deal in 2019. The European Skills Agenda for Sustainable Competitiveness, Social Fairness and Resilience (published in 2020) emphasised the importance of skills for the green transition. Action 6 of the Skills' Agenda presents concrete actions to support the acquisition of skills for the green transition, including the definition of a taxonomy of green skills, which was published in January 2022 (ESCO, 2022). Furthermore, in a vision set out in 2020 regarding the European Education Area, to be achieved by 2025, the Commission proposed new initiatives and investment in the area of education and training. This vision is underpinned by six dimensions, one of which consists of the green and digital transitions.

As Europe rebuilds after the COVID-19 pandemic and sets out an ambitious goal to become climate-neutral by 2050, it is equally important to ensure that existing and new education and training policies and practices address, rather than exacerbate, current labour market disadvantages. As such, this report is of interest and relevance to policymakers in relevant sectors at both EU and Member State levels, in addition to public employment services, education and training providers, social partners and other stakeholders involved in designing, implementing, monitoring and evaluating IVET and LLL provision that targets the working-age population, as well as labour market policies that focus on the creation of high-quality green(er) jobs supporting a diverse workforce.

### **1.2. Aims and research questions**

The overall aim of this report is to present a review and analysis of the existing research evidence pertaining to access to, and the process of acquiring skills for, the green transitions across IVET, as well as LLL opportunities for people already in the labour market. Particular attention is paid to the identification of factors that facilitate or hinder equal and just access to educational and training provisions, as well as identifying societal groups that are affected by these factors (both positively and negatively). The report also presents examples of promising practices that enable potentially disadvantaged group(s) to access adequate learning opportunities.

These research aims have been operationalised into the following three specific research questions, which have guided the review and analysis:

1. What are the characteristics of green(er) jobs, and what skills do they require?<sup>1</sup> How are green(er) jobs / green skills grouped analytically to assess the needs across particular categories of jobs / skills?
2. To what extent do current education and training measures in the provision of IVET and LLL ensure equal access to and acquisition of green(er) skills? Are there any societal groups that are disadvantaged and require more support to access green(er) skills education and training opportunities?
3. Which experiences from EU Member States can serve as examples of promising practices to create equal and just opportunities for green(er) skills education and learning for all learners?

### **1.3. Methodological approach**

A targeted literature review was carried out to identify, review and synthesise evidence. To capture the most up-to-date and relevant evidence within the well-defined and relatively narrow scope of this paper, a research protocol was developed that included a list of search words and word strings. Searches were conducted on Google Scholar and the Education Resources Information Centre (ERIC)<sup>2</sup>. In addition, the team also ran complementary targeted searches on relevant research published by a selected number of international and European organisations and agencies that focus on education, skills and training policy. The search encompassed sources published in English in the last 10 years, with particular attention being given to the most recent publications (i.e. those published since 2017). The search focused on sources assessing the current situation, while any future-oriented papers were limited to reports assessing the upcoming ten years at most.

A total of 80 sources identified in the literature search were assessed as being relevant to the present study, and were included for review. The list of reviewed sources can be found in Annex A – Bibliography. This comprises 46 sources that directly informed the analysis (listed under the References heading),<sup>3</sup> and another 34 sources that guided the overall analytical approach (listed under the heading 'Additional sources'). All evidence was analysed and synthesised into a coherent narrative in line with the key research questions. When reviewing the evidence, particular attention was paid to any examples of practice that were intended to provide workers and potential learners with access to green(er) education and training provision. The aim of this was to identify key features that facilitate equal and just access, providing an overview of the preconditions for access to provision (such as structural conditions, the set-up of learning systems, the characteristics of learners and providers, and the landscape of provision), as well as barriers (and how they can be overcome). However, during our review, a relative scarcity of examples was noted, as well as a general lack of evidence regarding the effectiveness of the approaches adopted in these examples. All evidence has been summarised in the text boxes in Chapter 3. These practices could be used as a learning tool that may build the capacity of stakeholders if replicated in other geographical and/or sectoral contexts, and thus have the potential for transferability. However, these examples should be read taking into account the caveat of limited to no evidence regarding their effectiveness.

It should also be noted that there was no consistency in the sources reviewed regarding the use of the term "green". Some sources use "green"; others "greener" and "greening".

---

<sup>1</sup> In the context of this analytical report, the primary focus is on work-related instrumental/technical skills, rather than broader citizenship skills.

<sup>2</sup> ERIC is a comprehensive, searchable, internet-based bibliographic and full-text database of education research and information. It is widely used by the academic and policymaking community when conducting education, skills and training-related research. Source: <https://eric.ed.gov/?faq>

<sup>3</sup> It must be noted that most of these sources discussed aspects relating to green skills in general, and only a small number of sources were found to directly discuss the topic of access to green skills across education and training systems.

For consistency, we use the term “green(er)” when discussing jobs, skills, education and training provision, and “green” when referring to the economy and transition (e.g. “green transition”). Citations include the terms as they are used in the original source.

## 2. Skills for the green transition

This chapter addresses the first research question by summarising the analysis of evidence and discussions on the definitions of green(er) jobs and the skills requirements for these jobs. Providing an outline of the skills required for the green transition, this chapter continues by summarising existing analytical taxonomies and frameworks used to categorise green(er) skills and jobs.

### 2.1. Definitions of green(er) jobs and skills

Until autumn 2022, no commonly adopted approach existed to define and measure green(er) jobs and skills at international, EU or national levels, with various organisations and governmental agencies formulating and adopting their own definitions and approaches. In general, the definitions available covered a broad spectrum of approaches depending on their context, i.e. from a narrow view focusing on environmental conservation, to a far wider view encompassing any job and skill that directly (or even indirectly) contributes to mitigating climate change and detrimental impacts on the environment (UNESCO, 2021). Historically, a narrower understanding was more prevalent; however, over the years, there has been a notable shift towards defining green(er) jobs as any job that encompasses a range of skills and tasks required for the green transition. For instance, whereas Cedefop’s 2012 definition of ‘green jobs’ focused more on the labour market, its most recent definition in 2022 takes a broader societal approach (see Box 1).

These debates regarding the definition of green(er) jobs continue. For example, Kwauk and Casey (2021) recently argued that most definitions of green(er) jobs are still too narrow, and pay insufficient attention to the dimension of equality and the rights of disadvantaged groups (e.g. the dimension of gender equality, the rights of people of colour and indigenous populations), as well as wider interdependencies in the socio-ecological systems upon which human economies rely. Similar conclusions were also reached by other authors when assessing the European regulatory and policy frameworks that relate to green transitions, skills and equality. For instance, Allwood (2022:1) observed that, in general, the green and gender equality priorities mostly “exist in parallel and rarely intersect”. She noted that differences in how well individuals are prepared and what skills they possess depend on structural inequalities including gender, class, ethnicity, age, location and ability. The paper emphasised that green goals would only be achieved in a just and equal way if the approach of intersectionality is adopted, giving due consideration to all socio-economic and demographic factors.

Analysing the existing literature, Kwauk and Casey (2021) found that green skills could be defined according to three paradigms: (1) skills for green jobs – that is, looking at skills through a technical lens and focusing on their capacity to “care for others and the environment” (p. 4); (2) green life skills – described as having generic capacities which are made up of cognitive competencies, interpersonal skills and intrapersonal competencies that help “solving practical problems, making decisions, and behaving in green(er), more sustainable ways” (p.4) in any job; and (3) skills for a green transformation – conceptualising green skills through a much broader sociological lens as having “transformative capacities (...) needed to disrupt and change both the individual and structural factors that exacerbate the climate crisis” (p.5) (Kwauk and Casey, 2021). Pavlova (2018) takes a similar approach when looking at generic green skills, which appear to align with the key competencies employers already recognise as being crucial for the modern workforce. Most importantly, however, they are contextualised within a perspective of environmental awareness and an understanding of sustainable development (Pavlova, 2018). Both studies conclude that the creation of a framework for green(er) skills

is vitally important for the development of training programmes to will helping in moving towards green(er) jobs in the future.

The evolving definition of green(er) jobs was noted in the Employment and Social Developments in Europe report by the European Commission (2019a). The authors observed that while initial definitions of green(er) jobs focused predominantly on jobs that were directly green(er), over time these definitions were expanded to also include “varying degree of ‘greenness’ and a spectrum of green jobs (...) covering occupations with green(ing) tasks and/or jobs in circular economy value chains” (EC 2019a: 173).

Evidence from the mapping exercises conducted by Cedefop (2018; 2019) and the EC PES network (2021a) confirm the existence of a variety of definitions of and approaches to green(er) jobs. The review of evidence from across the EU Member States by the EC PES network (2021a) shows that there is no single common agreed definition, and that different EU Member States apply different definitions depending on the context. Furthermore, certain countries – for instance, France and Italy – distinguish between “green jobs” and “greening jobs”. A “green job” is defined as having the purpose of improving the environment, while a “greening job” does not have this direct focus, but still includes an environmental component. According to this definition, greening jobs integrate “skills building blocks” to take into account the environmental dimension (EC PES network 2021a)<sup>4</sup>.

Various definitions of green(er) jobs and skills formulated and adopted by international and EU organisations are shown in Box 1.

#### *Box 1. Definitions of green jobs and skills*

Typically, the definitions developed by international and EU organisations adopt a broad and comprehensive approach<sup>5</sup>, as shown by the following definitions:

- The **ILO’s** (2018) definition of a “green job” focuses on the job’s characteristics, and states that “green jobs” are “jobs that reduce the consumption of energy and raw materials, limit greenhouse gas emissions, minimize waste and pollution, protect and restore ecosystems and enable enterprises and communities to adapt to climate change.” This definition highlights that “green jobs” are jobs that reduce the environmental impact of enterprises and economic sectors to ultimately sustainable levels, and at the same time meet the requirements of decent work: adequate wages, safe conditions, workers’ rights, social dialogue and social protection (Cedefop 2019a; UNEP et al. 2008).
- **Cedefop’s** definition of “green jobs” characterises them according to the range of skills involved. “Skills” is an overarching term denoting “the knowledge, competence and experience needed to perform a specific task or job”. The most recent definition by Cedefop (2022:1) of “skills for the green economy” states that these are “the knowledge, abilities, values and attitudes needed to live, work and act in economies and societies seeking to reduce the impact of human activity on the environment.”<sup>6</sup> Skills development in this context comprises all forms of human resources development: lifelong learning, including initial and continuing vocational education and training; and life-wide learning, including formal and informal/non-formal learning (Cedefop 2019a). Cedefop’s definition has also been adopted by other European agencies, for instance in the European Classification of Occupations, Skills and Competences (ESCO) (ESCO 2022).

<sup>4</sup> “Greening jobs” appear similar to the Kwauk and Casey (2021) definition of “green life skills”.

<sup>5</sup> It must be noted that some definitions are broader than others, e.g. Cedefop’s definition seems to be broader than the ILO’s definition.

<sup>6</sup> This definition builds on Cedefop’s 2012 definition of ‘green’ skills: “the knowledge, abilities, values and attitudes needed to live in, develop and support a society which reduces the impact of human activity on the environment”.

- The **OECD** has referred to the definitions of the ILO or Cedefop, depending on the publication<sup>7</sup>. Research by the OECD focuses more on “green skills” rather than on “green jobs”.

However, in autumn 2022, the Inter-Agency Working Group on Work Based Learning, consisting of the European Commission, European Training Foundation (ETF), Cedefop, OECD, ILO and UNESCO, published a definition of “skills for the green transition”, based on the respective definitions employed by these organisations. **“Skills for the green transition” are understood as skills and competences, but also the knowledge, abilities, values and attitudes needed to live, work and act in resource-efficient and sustainable economies and societies.** They are:

- **technical:** required to adapt or implement standards, processes, services, products and technologies to protect ecosystems and biodiversity, and to reduce energy, materials and water consumption. Technical skills can be occupation-specific or cross sectoral; and
- **transversal:** linked to sustainable thinking and acting, relevant to work (in all economic sectors and occupations) and life. Alternatively referred to as ‘sustainability competences’, ‘life skills’, ‘soft skills’ or ‘core skills’ (EC et al. 2022).

Existing differences between how countries define and measure green(er) jobs and skills make it difficult to compare labour market trends and patterns between countries, as well as to assess the provision of education and skills to address green(er) skills needs (see Chapters 3 and 4). Nevertheless, as the Cedefop (2019) report concludes, it is now universally acknowledged and agreed that all jobs will need greening rather than just jobs in specific sectors, and that green(er) jobs and skills can be defined by a set of attributes.

In addition, as noted in the Cedefop (2019) and OECD (2021) reports, the link between environment, employment and skills policies at national level is often weak. Some national government departments and/or organisations that are particularly affected by the green transitions have produced plans and strategies, but these have typically been individual initiatives, often implemented on an *ad hoc* basis. In general, as Cedefop (2019) concluded, there is paucity of national-level regulations, policies and strategies connecting climate and environmental transitions with employment, education and skills anticipation and intelligence data. Systematic and comprehensive approaches are still rare, and skills development for green(er) jobs continues to be largely *ad hoc* (ILO, 2019a). The OECD (2021) report highlights that “the multiplicity of actors calls for the establishment of adequate mechanisms to ensure both horizontal [among the different policy areas] and vertical [among the various levels of government] coordination for a successful green transition”. Similar suggestions are also voiced in studies by the ILO (2019a, 2019b), which call for strategic and long-term planning, as well as coordination between policy areas (the environment, education and employment, but also taxation, investment and innovation) and between stakeholders (public authorities, social partners, private sectors, and education and training providers) in order to adequately design and deliver school curricula and VET and LLL provision to respond to the changing needs of the labour market. Studies (e.g. OECD 2021, ILO 2019a, 2019b) also suggest that the interconnected nature of climate, environmental and social challenges calls for better alignment, synergies and sequencing of policy responses, as well as a consistent monitoring framework to ensure that green transitions are people-centred and deliver well-targeted, efficient and effective outcomes that serve the people and the planet. In addition, these studies also indicate that environmental goals will not be achieved solely through the greening of workplaces and

---

<sup>7</sup> For instance, an OECD paper by Chateau and Mavroeidi (2020) refers to Cedefop’s definition of “green skills”, whereas in the OECD paper on Employment Implications of Green Growth: Linking jobs, growth, and green policies (2017), the ILO’s green job creation scenarios are used.

green(er) workers, but also through a wider range of interconnected greener transitions (e.g. green(er) consumers, green(er) citizens etc.) Participatory approaches are seen as crucial, as clear communication with stakeholders will facilitate buy-in and the acceptability of policy and practice change. Weak coherence between environmental and employment policies is also evident in current monitoring and evaluation activities relating to green skills.

Analysis of the most recent EU policy developments and the wider context shows that efforts are being made to improve the integration of green(er) skills into broader policy agendas. However, these efforts are still not applied comprehensively across all EU-level policies. For instance, our review identified that the Recovery and Resilience Facility explicitly mentions Green Skills and Jobs as one of the policy areas under the pillar of the Green Transition (EC, 2022); however, no definition of green(er) skills and jobs is given in this document. Under the Recovery and Resilience Plans (RRPs) already submitted by 26 Member States, EUR 1.5 billion will be spent on areas related to green(er) skills and jobs (EC, 2022). In addition, the EU's initial Fit for 55 package did not explicitly mention green(er) skills, but included a Social Climate Fund aimed at addressing the social and distributional issues relating to the green transition (EC, 2021b). The Fund is intended to help Member States reform policies in relation to green skills. However, in the second Fit for 55 package, the Commission proposed a Council recommendation on a fair transition that included roles for education, training and skills. Our review did not identify any other recent EU-level policy documents that specifically mention green(er) jobs and green skills.

## **2.2. Characteristics of green skills**

The available evidence suggests that green(er) skills should be viewed more holistically than other types of skills, as the new skills required will rely on a more comprehensive skillset rather than replacing existing skills (Cedefop, 2019a; UNESCO, 2021; EC PES network, 2021a). The new skills paradigm also emphasises that green(er) skills will require (in most cases) a high(er) degree of autonomy and responsibility, as projects will be implemented through the working together of multidisciplinary teams of professionals with diverse backgrounds (Cedefop, 2019a)<sup>8</sup>. In addition, analysis of the data indicates that green(er) jobs will require higher levels of non-routine cognitive skills and a higher dependence on formal education, work experience and on-the-job training than other jobs; and that green(er) work activities are characterised by lower degree of routine (Consoli et al, 2015). Furthermore, some analyses of employment dynamics suggest that green(er) jobs may be biased against the skills of manual workers (routine skills) and managerial and social skills (non-routine interactive skills), while favouring technical, scientific and professional skills (non-routine cognitive skills) (Marin and Vona, 2018). However, further research into this aspect is required to reach a definitive conclusion (see the section on skills levels in Access to and acquisition of green skills in IVET and LLL).

Overall, the evidence assessed by the ILO (2015) suggests that green(er) skills would be required to address four types of occupational changes in the labour market:

- Changing need(s) for existing occupations;
- Changing occupations;
- Newly emerging occupations; and
- New skill(s) needs across occupations.

Discussions are ongoing as to how to categorise and label the skills and competences needed for the green transition. Although no universal skills framework exists, most sources agree that green(er) skills can be broadly classified into the following two main categories:

---

<sup>8</sup> It can be noted, however, that some green(er) jobs may be routine and regulated (e.g. in waste management), rather than autonomous.

- Generic and core skills; and
- Knowledge-based technical skills.

Generic and core skills – sometimes also called “portable skills”, “transversal skills” or “transferable skills” due to their features (ILO, 2015; EC PES network, 2021a) – include a set of soft and technical skills that encompass general knowledge, attitudes and values. These skills are necessary for an individual to contribute to sustainable social, economic and environmental development in any job. Such skills enable the development of a green(er) mindset and the adoption of generic operational practices that minimise environmental impacts (EC PES network, 2021). These skills and abilities are commonly regarded as necessary or valuable for effective action in virtually any kind of work, learning or life activity. They are “transversal” because they are not exclusively related to any particular context (job, occupation, academic discipline, occupational sector, group of occupational sectors) (ESCO 2022). Examples of generic and core skills include: environmental awareness; attitudes and willingness to learn about sustainable development; strategic and leadership skills; adaptability and transferability skills; co-ordination, management and business skills; entrepreneurial and innovation skills; and communication, consulting and networking skills (ILO, 2015). Some evidence suggests that by instilling these generic skills and capacities in individuals, more sustainable behaviours and actions can be achieved across a variety of contexts in life (see, for instance, Kwauk and Casey, 2021)).

Knowledge-based technical skills consist of specialised and technical knowledge of sciences, including engineering, environmental and biological skills. These are generally not entirely new skills, but rather “an add-on or an amalgam of existing skills” (Cedefop, 2019a:3). Some of these technical skills fulfil the direct requirements of the green economy, whereas others support the wider transition to a low-carbon, green economy. These skills are regarded as playing a crucial role in the development, implementation and management of various actions, phases and processes in the green and circular economy strategies, life cycles, regulations and legislation (EC PES network, 2021a).

As noted in a report assessing the impacts of circular economy policies on the labour market, there is a trend towards cross-cutting competences. This trend highlights the importance of transversal skills and the adaptability of the workforce (CE et al. 2018). In this respect, this approach to green and climate change action suggests that generic and core skills and knowledge-based technical skills together constitute instrumental skills (CE et al. 2018). There are also suggestions in the literature that a potential third set of transformative skills is also needed to ensure that green transitions also transform unjust social and economic structures. These transformative skills<sup>9</sup> and capacities include, for instance, the ability to analyse unequal systems of power, political agency and activism, systems thinking, as well as interdisciplinary and multidisciplinary thinking (Kwauk and Casey, 2021; Leichenko and O’Brien, 2020; Pirgmaier and Steinberger, 2019; Stevenson, 2006). Lastly, it is also argued that the division between the instrumental and the transformational may not be as clear-cut as it is conventionally understood to be (see, for instance, the Moyer and Sinclair (2020) paper based on a systematic review of 26 studies spanning approximately 20 years and covering four continents).

To establish which skills will be needed for the green transition, the ILO undertook a comparative analysis of 21 countries across various geographical regions, including both lower- and higher-income countries (ILO, 2019b). A mix of qualitative and quantitative methods was used for data gathering and analysis. The results of the ILO’s analysis are shown in Table 1. Main core skills required for green(er) jobs, by skill level of occupation.

---

<sup>9</sup> Further analysis of the transformative skills is beyond the scope of this paper.

Table 1. Main core skills required for green(er) jobs, by skill level of occupation

<b>Required across the labour force</b>	<ul style="list-style-type: none"> <li>• Environmental awareness and respect; willingness to learn about sustainable development</li> <li>• Adaptability and transferability skills, to enable workers to learn and apply the new technologies and processes required to green their jobs</li> <li>• Teamwork skills, reflecting the need for organisations to work collectively on tackling their environmental footprint</li> <li>• Resilience, to see through the changes required</li> <li>• Communication and negotiation skills, to promote required change to colleagues and customers</li> <li>• Entrepreneurial skills, to seize the opportunities of low-carbon technologies and environmental mitigation and adaptation</li> </ul>
<b>Required in medium to high-skilled occupations</b>	<ul style="list-style-type: none"> <li>• Analytical thinking (including risk and systems analysis) to interpret and understand the need for change and the measures required</li> <li>• Coordination, management and business skills that can encompass holistic and interdisciplinary approaches incorporating economic, social and ecological objectives</li> <li>• Innovation skills, to identify opportunities and create new strategies to respond to green challenges</li> <li>• Marketing skills, to promote green(er) products and services</li> <li>• Consulting skills, to advise consumers about green solutions and to spread the use of green technologies</li> <li>• Networking, IT and language skills, to perform in global markets</li> <li>• Strategic and leadership skills, to enable policy-makers and business executives to set the right incentives</li> </ul>

Source: ILO (2019b).

### 2.3. Taxonomies and frameworks for green(er) jobs skills

Obtaining labour market intelligence data on green(er) skills is crucial to understanding current and anticipated trends, emerging skill mismatches and potential bottlenecks, and for producing systematic and comprehensive analyses of training needs. Assessment skills needs and analysing the prevalence of specific trends among certain population groups and in specific locations (regions, countries) also enables the monitoring of social fairness and (in)equalities, and can subsequently be used to inform policy responses to address any challenges identified – for instance, to support the acquisition of skills for the green transitions via VET and LLL strategies and opportunities.

The process of anticipating and monitoring skills needs (e.g. via taxonomies and frameworks) has been high on political agendas for a number of years, both in Europe and internationally<sup>10</sup>. However, the ability to identify green(er) jobs and skills requirements in taxonomies is a relatively new addition. Measuring green(er) jobs is challenging, due to the lack of a universally adopted definition of green(er) jobs and their dynamic nature. Green(er) jobs often sit across sectoral boundaries and are continuously being redefined as we gain a better understanding of new and changing occupational needs. The paucity of data regarding the incidence of green(er) jobs also adds to this challenge of measurement (ILO, 2015). Nevertheless, efforts have been made to develop taxonomies and frameworks for green(er) jobs. To enable some degree of categorisation of jobs, these

<sup>10</sup> For instance, the work of the OECD and ILO in helping countries to improve their skills anticipation systems and labour market information (ILO, 2019a).

developments map granular data on the knowledge requirements, competences and content of occupations. These categorisations are intended to strengthen and streamline our understanding of the skills needed for the green labour market transitions, and to inform the decisions of policymakers, educators, trainers, employers and employment services to facilitate policy and practice responses to the demands of the green labour market. For instance, taxonomies are used not only to assess skills needs but also to examine the supply of these skills across population groups, and thus detect any systemic labour market inequalities. As presented in further detail below, some of these taxonomies and frameworks build on standard sectoral and occupational classifications, whereas others take a more tailored approach by coming up with specifically devised classifications.

To further advance the green and sustainability agenda, international and EU actors have put forward concrete actions with regard to the development and practical application of taxonomies and frameworks for green skills and competencies. The following paragraphs briefly present those taxonomies and frameworks that are used in the EU<sup>11</sup>. However, it must be noted that as yet, relatively little information exists on how the information and data on green(er) jobs and skills included in these taxonomies and frameworks is used in practice to plan education and training provision, including access to such provision.

### 2.3.1. European Commission taxonomy based on O\*NET (EC, 2019b)

The O\*NET<sup>12</sup> – Occupational Information Network, working under the auspices of the US Department of Labor, has developed the ‘Green Economy’ programme, which includes a database of occupation-specific information (Dierdorff et al. 2009). The database contains a very comprehensive list of tasks and skills used in more than 900 occupations. It encompasses various job-related aspects such as work tasks, education and experience requirements, as well as the characteristics of work content (Consoli et al. 2015). O\*NET applies a broad definition of green(er) jobs, and assesses the potential for “greening” activities within existing jobs and new jobs, while also assessing how jobs are evolving to become green(er).

Building on the taxonomy developed by O\*NET<sup>13</sup>, the EC identified five main categories of green(er) jobs (EC, 2019b). Its taxonomy goes beyond existing jobs to allow newer, larger and more diffuse developments to be captured, as well as changes in occupational profiles, task structures and skills.

The five main categories in the EC taxonomy include:

1. **Green Increased Demand** (‘Green ID’) jobs: existing jobs that are expected to be in high demand due to greening, but which do not require significant changes in tasks, skills or knowledge. These are indirect green jobs, e.g. bus drivers in the sustainable public transport sector.
2. **Green Enhanced Skills** (‘Green ES’) jobs are existing jobs that require substantial changes in tasks, skills and knowledge as a result of greening (e.g. construction workers, architects, teachers).
3. **Green New and Emerging jobs** (‘Green NE’) are unique jobs (as defined by worker requirements) created to meet the new needs of the green economy.

---

<sup>11</sup> Several other skills taxonomies and frameworks have been developed by international and national public and private organisations, e.g. OECD’s Programme for the International Assessment of Adult Competencies (PIAAC). Some of these taxonomies and frameworks also classify green skills, e.g. the World Economic Forum Skills Taxonomy (WEF, 2021) and LinkedIn green skill taxonomy (LinkedIn, 2022).

<sup>12</sup> <https://www.onetonline.org/>

<sup>13</sup> The O\*NET outlines three main categories of green jobs:

- (1) Green Demand – existing occupations that are expected to experience significant employment growth due to the greening of the economy;
- (2) Green Enhanced Skills – existing occupations that are expected to undergo significant changes in terms of task content; and
- (3) Green Emerging – new occupations that emerge as a response to the specific needs of the green economy (Consoli et al. 2015).

4. **Green Rival Jobs** – non-green jobs that are “similar” to one of the three “green” job categories, either because they involve very similar tasks or (in the case of new employees) because they require similar skills and other worker attributes (e.g. drivers of lorries using diesel or petrol fuel).
5. **Other Non-Green Jobs** – non-green jobs that are less likely to be affected (at least in the short term) by the greening of the economy, because of their lack of similarity to green occupations, for instance medical occupations such as medical doctors, pharmacists or nurses.

### 2.3.2. ESCO green skills classification methodology<sup>14</sup>

European Skills, Competences, Qualifications and Occupations (ESCO) is the European multilingual taxonomy of skills, competences, qualifications and occupations. It provides a common language on occupations and skills, the relationships between them, and details which skills are essential or optional for a specific occupation. By using common reference terminology, ESCO aims to make the European labour market more effective and integrated, as well as facilitating more efficient exchange of knowledge and information between education and training providers, employers, employment services and career advisors, and jobseekers. Among other aspects, recent ESCO developments have focused on adding information at the level of skills to enable green(er) skills and knowledge concepts to be distinguished, making the whole ESCO database searchable for green(er) skills. In the ESCO database, a total of 571 skills and knowledge concepts across industry sectors are labelled as “green” (ESCO, 2022). By classifying the green transition in the labour market in terms of technical and transferable skills needs, the taxonomy is intended to support upskilling and reskilling, as well as the statistical monitoring of the greening of professions (ESCO, 2022). The ESCO green(er) skills classification methodology builds upon taxonomy work at international, European and national levels, including that carried out by the ILO and OECD, in the US (O\*NET), France, Italy and the UK, as well as wider policy developments at EU level.

### 2.3.3. GreenComp

The European Sustainability Competence Framework (‘GreenComp’) is a reference framework providing an agreed definition of sustainability as a competence. It provides a common ground for learners, offering guidance and support to education and training institutions with regard to teaching and learning for green and environmental sustainability. It addresses all learners in any learning setting, and consists of 12 competences organised into four areas: embodying sustainability values; embracing complexity in sustainability; envisioning sustainable futures; and acting for sustainability. The aim of GreenComp is to foster a sustainability mindset, helping users to develop the knowledge, skills and attitudes needed to think, plan and act with empathy, responsibility and care for the planet (Bianchi *et al.* 2022).

### 2.3.4. Skills OVATE tool

This tool<sup>15</sup>, developed by Cedefop, provides detailed information on jobs offered and skills demanded by employers, based on online job advertisements (OJAs) from across the EU Member States. To show up-to-date labour data and skills trends, the database of OJAs is drawn from thousands of sources, ranging from private job portals and recruitment agencies to public employment service portals, corporate websites and online newspapers. The database provides information regarding occupations, skills and regions using international classifications. Data are updated four times a year, and the Skills-OVATE database presents data for the last four available quarters. As of 2022, Cedefop is exploring the possibility of using this approach to lay the groundwork for a classification of green(er)

<sup>14</sup> <https://ec.europa.eu/social/main.jsp?catId=1326&langId=en>

<sup>15</sup> <https://www.cedefop.europa.eu/en/tools/skills-online-vacancies>

skills (Cedefop, 2022). This could provide a powerful tool to obtain real-time data on green(er) skills which, in turn, would facilitate understanding of emerging labour market trends and the implementation of applicable and relevant VET strategies and programmes.

### **2.3.5. Developments at national level**

Frameworks and observatories anticipating skill needs have been also put in place across the EU Member States. In France, the National Observatory for Green Economy Jobs and Skills (Observatoire national des emplois et métiers de l'économie verte, Onemev), created in 2010, monitors the implications of green transitions on jobs and skills, and matches vacancies with job seekers. It brings together a broad range of stakeholders, including relevant national ministries and agencies, key public employment services, the main TVET associations, the national statistical institute, research bodies, and regional employment and training observatories (ILO 2019a; 2019b; OECD 2016; also cited in OECD 2021). In Italy, the analysis of the needs of local labour markets takes into consideration environmental and social perspectives. This approach has contributed to the introduction of new skills into training programmes, such as the evaluation of "the environmental impact of energy systems" and "the environmental and strategic impact assessment" (OECD 2021).

As can be seen above, considerable efforts have been made to develop taxonomies and frameworks. However, the sources reviewed, predominantly from international organisations, do not provide a clear indication as to how these developments have been used in practice, and to what effect. This is probably due to the fact that such frameworks are still very new, while updating/adopting curricula usually takes a long time. This makes it difficult to link the data from taxonomies with findings concerning particular groups in society being disadvantaged in the labour market due to the greening of jobs and requirements for green skills (see Chapter 3).

## **2.4. Prevalence of green(er) jobs and need for green(er) skills**

Taking stock of the available data from across taxonomies and other sources, this short section outlines key labour market trends in relation to green(er) jobs. This includes a brief analysis on green(er) jobs as a share of all jobs in the EU, and the observed and forecasted trends relating to the prevalence green(er) jobs' prevalence. It must be noted, however, that despite numerous sources outlining generic trends in relation to green(er) jobs, relatively few studies have so far provided reliable and more granular statistics regarding the number of green(er) jobs, their sectoral and occupational concentration, and the socio-demographic characteristics of workers in green(er) jobs<sup>16</sup>. It should also be noted that non-green(er) jobs will still play an important role in certain economic sectors.

Overall, the net employment effect of the transition to a green economy is expected to be neutral or slightly positive in the long term (OECD 2021)<sup>17</sup>. The World Economic Forum has identified jobs in the green economy as one of the seven emerging professional clusters<sup>18</sup> in which it expects to see growth in the 'jobs of tomorrow' (WEF 2020; cited in Taylor et al., 2022). The greening of the economy is in progress, and over the last decade the number of green(er) jobs has grown, both in absolute terms and as a proportion of total employment. According to the EC PES network (2021a) report, green(er) jobs constitute up to 8% of all jobs, while greening jobs constitute up to 14%. However, as indicated in

---

<sup>16</sup> A similar conclusion was reached by the EC (2019).

<sup>17</sup> It must be noted that a report from the ILO (2018), which estimated substantial job gains as a result of green transition, used a different methodological approach and a different mix of policies to estimate the effects. Other sources reviewed are in agreement with moderate employment gains, as employment gains due to an increase in green(er) jobs will be countered by job losses in other sectors.

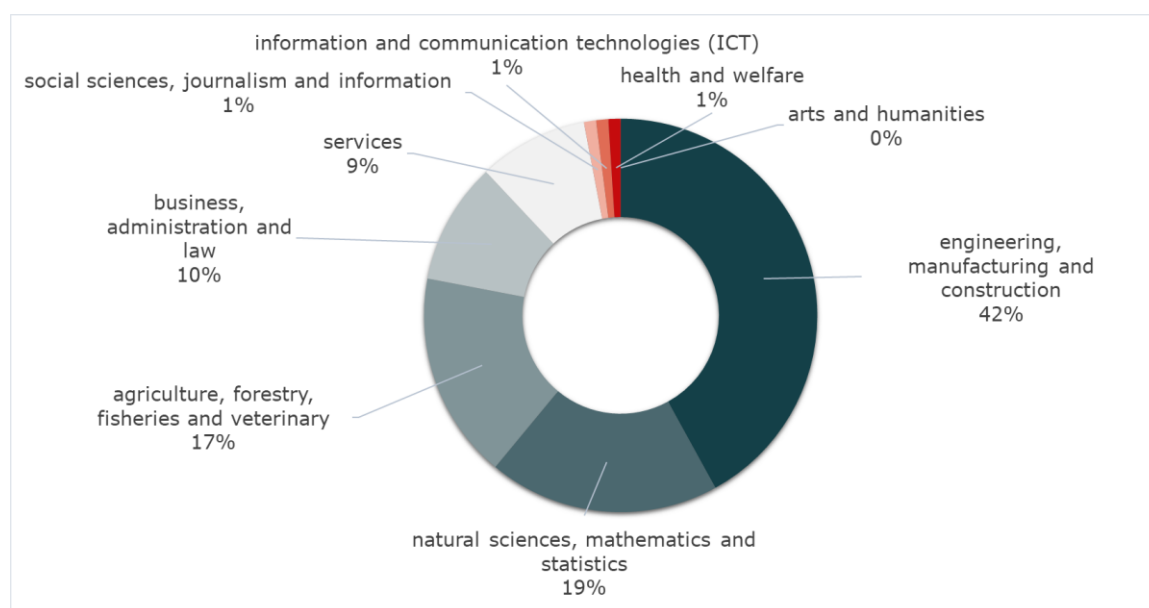
<sup>18</sup> The seven growth professional clusters include: data and AI; engineering and cloud computing; people and culture; product development; sales, marketing and content; the care economy (including health); and the green economy (WEF 2020).

earlier sections, the lack of consistency with regard to green(er) jobs and the skills definitions adopted by particular agencies and institutions makes it difficult to compare the figures on green(er) jobs and skills provided by different sources. This is due to varying degrees of narrowness in such definitions, some of which only include jobs that actively improve the environment, while others include jobs that improve the environment indirectly, such as an administrative job in an office.

It is estimated that green(er) jobs are likely to become more prevalent with the greening of economies due to the European Green Deal and the commitment of Member States to move towards a green and climate neutral economy. The greening of the economies is also likely to be accelerated (at least in part) by the recovery plans put in place to cope with the effects of the COVID-19 pandemic (EC PES network, 2021a). Studies have assessed that around one-third of jobs have the potential to be affected by greening and to be green(able) by the mid-2020s (e.g. Consoli et al., 2015). Cedefop's 2021a skills forecast scenario projects around 1.2% additional growth in employment, which translates into approximately 2.5 million additional jobs by 2030, with the strongest job growth being in sectors with high greening potential (Cedefop, 2021a). A report by LinkedIn (2022) indicates that the demand for green talent had already accelerated ahead of the overall hiring rate in most economies around the world in 2019, as green(er) workers were hired at a higher rate than non-green workers. Overall, LinkedIn's data suggest that the share of green(er) workers in the global workforce increased from 9.6% in 2015 to 13.3% in 2021 (LinkedIn, 2022).

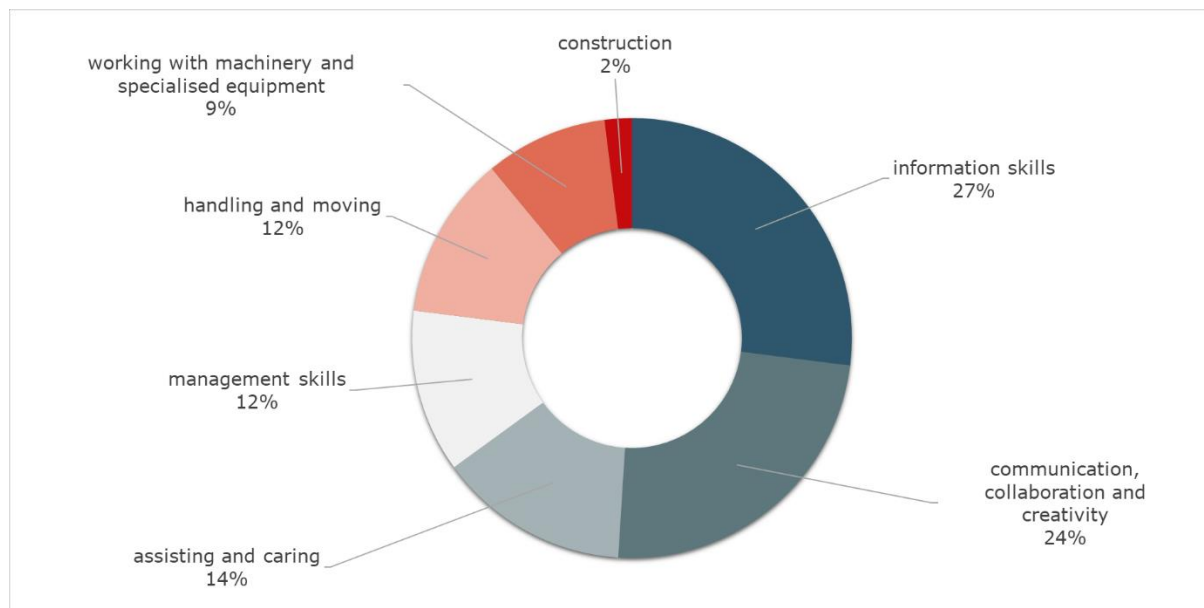
Analysis of ESCO taxonomy data indicates that green knowledge concepts (technical skills) are predominantly needed in the engineering, manufacturing and construction sectors (42% of all green knowledge concepts are found in these sectors), and in industrial activities related to natural sciences, mathematics and statistics (19% of all green knowledge concepts are found in these sectors) (ESCO, 2022) (see Figure 1). In terms of the types of green(er) skills, the ESCO taxonomy data show that around half of green(er) skills include information skills, as well as communication, collaboration and creative skills (see Figure 2).

*Figure 1. Prevalence of green(er) skills across industry sectors*



Source: ESCO (2022).

Figure 2. Types of green(er) skills



Source: ESCO (2022).

As green(er) skills constitute the building blocks of the green transition, it is critical that all workers – both current and future – have opportunities to acquire green(er) skills. Forming a green(er) skillset from the outset is a role of the formal IVET system in preparing future generations of workers. Those workers who are already in the labour market but who lack green(er) skills should be provided with opportunities to upskill. European Commission (2019b) analysis indicates that due to the growth in the green(er) sectors, demand for educational requirements that align with green(er) jobs has risen more quickly than that for other qualifications in the economy as a whole<sup>19</sup>. The authors suggest that focusing on and investing in the planning of education and training is vital to ensure that workers' skills meet the demands of the greening economy. Conversely, they observe that insufficient provision of green(er) skills will cause economies to lag behind in the green transitions, whereas unlocking human capital and green(er) skills has the potential to accelerate and power the green transition. The challenges with regard to access to and the acquisition of green skills are discussed further in Chapter 3 below.

### 3. Access to and acquisition of green skills in IVET and LLL

This chapter focuses on societal groups identified in the literature as being disadvantaged in the green transition process, and more specifically in relation to their access to and acquisition of green(er) skills. The chapter begins by summarising the evidence on factors that might facilitate or hinder access to green(er) skills and green(er) jobs. This is followed by a focus on three specific socio-economic dimensions identified in the literature with regard to characteristics that act as an advantage or disadvantage in terms of access to green(er) jobs for workers who possess them. In each of the sub-chapters, illustrative examples are presented of specific measures implemented by Member States that improve access to and acquisition of green(er) skills.

<sup>19</sup> It is worth noting that more recent documents, e.g. Council of the European Union (2022) "Council Recommendation on ensuring a fair transition towards climate neutrality" anticipates that the green transition will also create medium-skilled occupations that will help to attenuate the polarising effects (e.g. the hollowing out of the middle) caused by the digital transition.

### 3.1. Key facilitators and obstacles

Access to and acquisition of green(er) skills can be either facilitated or hindered by a number of factors. Some of these pertain to all societal groups, while others affect specific learners and workers due to structural (dis)advantages and a variety of other factors.

Several studies have concluded that access to adult learning and education more generally, and the acquisition of green(er) skills in IVET and LLL more specifically, have improved in recent years – but many challenges still persist. The available sources suggest variety of facilitators exist to help learners and workers acquire green(er) skills and gain access to green(er) jobs. Multiple sources note that having curricula at all education levels, throughout primary, secondary and higher education, that include awareness of climate change and environmental matters (ILO, 2018; Cedefop, 2019a; UNESCO, 2021), equips all learners with a basic level of green(er) skills, even if learners do not explicitly aim to acquire them. However, such curricula are not yet widely available. Moreover, several sources highlight the importance of social dialogue and the involvement of a wide range of stakeholders from the private, public and third sectors in the development and implementation of new curricula and programmes, and in the dissemination of information about these, to ensure broad perspectives are captured and achieving buy-in across different stakeholder groups (EC, 2019a; Chen et al. 2020; EC PES network 2021a; ILO 2015). Involving a range of stakeholders in preparation of the educational and training offer is also seen as a facilitator for improving the quality of adult learning and education provision, including participation levels (UNESCO, 2020), and for disseminating and ensuring access to information about education and training opportunities, so that potential learners are aware of what is on offer (Kwauk and Casey 2022). However, evidence regarding the involvement of stakeholders is scarce. Sources suggest that improved access is also facilitated by the availability of ‘train the trainer’ programmes, as these ensure that good and promising approaches can be promoted and implemented system-wide and across geographical locations (Cedefop, 2019a). Numerous sources also mention the importance of scaling up existing programmes such as unemployment protection schemes and public employment programmes, and the importance of on-the-job training programmes (ILO, 2018; UNESCO<sup>20</sup>, 2021; Cedefop, 2019a). As mentioned earlier, evidence regarding the implementation of such approaches is so far very limited, and thus it is not yet feasible to assess their effectiveness.

Available evidence shows that the provision of standard education and training programmes can address the education and training needs of the general population. However, a range of specific educational pathways is also needed to address the learning needs of particular disadvantaged and vulnerable groups (Kronsell, 2013; Kwauk and Casey 2022). The sources reviewed also suggest the need to include gender roles/models in terms of the curriculum, the delivery of the provision and participation in education and training activities, as this could be both a driver and an outcome of the green transition (Allwood, 2022; Cedefop, 2022). In fact, recent policy documents promote “double mainstreaming” that focuses on combining efforts towards gender-responsive environmental and climate action. For instance, the EU Gender Equality Strategy has proposed the use of the concept of double mainstreaming to capture linkages across the gender and climate policy cycle and actions (European Commission 2020; see also the work of the European Institute for Gender Equality<sup>21</sup>).

<sup>20</sup> Although not covered in this report, UNESCO has led the way as a provider of green skills. This has been achieved through a mix of programmes specifically aimed at youth, and numerous resources disseminated through their website. Examples of these include a practical guide for institutions on how to green TVET (<https://unevoc.unesco.org/up/gtg.pdf>), and a guidebook on green skills and lifestyles ([https://www.oneplanetnetwork.org/sites/default/files/youthxchange\\_guidebook\\_series\\_green\\_skills\\_and\\_lifestyles.pdf](https://www.oneplanetnetwork.org/sites/default/files/youthxchange_guidebook_series_green_skills_and_lifestyles.pdf))

<sup>21</sup> <https://eige.europa.eu/gender-mainstreaming/policy-areas/environment-and-climate-change>

The reviewed sources also point out that one of the most important overarching barriers that must be overcome initially, in order to understand the causes of unequal access to green(er) skills and jobs, is to address the lack of sectoral data. Existing data sources have not been (sufficiently) disaggregated along the main socio-demographic dimensions of gender, age and disadvantage/vulnerability status. This creates a challenge in addressing the skills gap in a sustained and timely manner (Kwauk and Casey, 2021). Solving this issue would help in eliminating skills gap challenges far more rapidly.

Sources also suggest that there are numerous areas in which public sector policies remain insufficient. These include a lack of funding, as well as slow progress in providing access (UNESCO, 2020; Marin and Vona, 2018). To solve these issues, a far greater level of coordination would be required between stakeholders (Cedefop, 2019a). Another challenge identified points to cultural and social norms that might prevent people from accessing green skills (IRENA, 2019; Kwauk and Casey, 2021). This is particularly relevant for older workers, who are less likely to participate in upskilling measures (EC PES network, 2021a).

### 3.2. Societal dimensions that affect unequal access

The reviewed sources detail the following axes of disadvantage while discussing how these can be addressed in order to promote and ensure more inclusive and just approaches to accessing green(er) jobs and skills:

- **Gender:** policies and practices promoting the attractiveness of green industries / occupations for both female and male learners, to ensure equal gender representation in green(er) jobs;
- **Age:** education and training system policies and practices geared towards young people in primary, secondary and higher education as well as workers, as part of LLL provision that addresses the continuous professional development needs at different career stages, to meet the training needs of individuals; and
- **Skills levels:** provision of equal training opportunities through formal education, reskilling and upskilling programmes and on-the-job learning to ensure that learners at all skill levels are prepared for the skills requirements of green(er) jobs.

Subsequent sections have been structured to enable the discussion of each of these axes in turn. However, the intersectionality of disadvantages across these social and economic dimensions is often a challenge, meaning that it is not always feasible to disaggregate findings into a single dimension. Where evidence exists, we also discuss other potential axes of inequality, such as location (the geospatial distribution of education and training provision, and of green(er) job creation) as well as broader vulnerabilities and disadvantaged populations, e.g. migrants and minority groups (Sami, Roma) (see Box 2), learners with disabilities etc. However, we emphasise the paucity of information available regarding vulnerable and disadvantaged groups, as well as the lack of disaggregated data<sup>22</sup>, despite the potential exacerbation of structural disadvantages by the greening of the economy and of jobs.

#### *Box 2. Increasing ethnic diversity in the environmental sector remains a challenge*

A research study commissioned by Wildlife and Countryside Link, a coalition of environmental charities, found that in 2021 in England, just 4.8% of environmental professionals had an ethnic minority background, compared with 12.6% of the workforce

<sup>22</sup> Some sources exist that discuss how these disadvantaged and vulnerable groups access general education provision, and the challenges they face (in terms of access and broader difficulties). However, our review did not identify evidence regarding specific challenges in accessing VET and LLL provision relating to green skills acquisition.

overall according to official figures (WCL, 2021). Among those surveyed in the study, most minority ethnic professionals indicated their inability to take up volunteering or low-paid jobs in order to gain experience as a barrier to entry, as well as a lack of clear career progression once working in the sector. Findings from this research study formed the basis for the development of a route map for the sector to help increase its ethnic diversity (WCL, 2021). The route map covers five years (from 2022 to 2027). The first year is intended to lay foundations; the second year focuses on equipping people with knowledge, skills and mindsets; and the final three years deliver the actual change (WCL, 2021). Each year is given concrete actions, with milestones for both organisations and the sector as a whole (WCL, 2021).

Source: WCL (2021).

### 3.3. Gender

Labour market data suggest that the transition to a green economy is not gender neutral. Overall, it is estimated that the green transitions resulting from the implementation of the European Green Deal will lead to a modest positive bottom line effect on employment (Cedefop, 2021a). However, while participation rates are expected to grow for both men and women, the increase in male participation between 2021 and 2026 is expected to be larger (Cedefop, 2021a) (see Figure 3. Change in EU labour force, absolute difference from baseline, 000s). A similar conclusion was reached by the ILO (2019), which assessed that up to 2030, both job creation and job destruction globally would be concentrated in male-dominated occupations. Furthermore, the analysis by the ILO (2019) suggests that the green transition will increase employment opportunities for women, although the scale of these advances will not be sufficient to offset prevailing gender-based inequalities in employment.

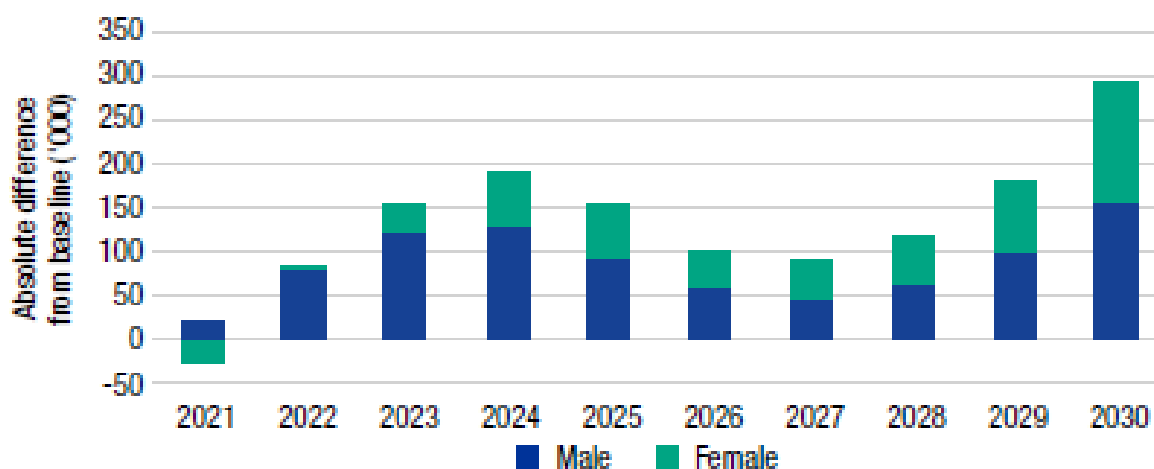
Historical data appear to confirm this forecast. For instance, an analysis of standardised skills data from LinkedIn profiles<sup>23</sup> suggests that men still constitute a higher share of green talent, and that men are transitioning into green(er) jobs at a faster rate than women. Globally, on average, there has been an increase in the share of female green talent as a share of all female talent from 6.4% in 2016 to 8.9% in 2021. Meanwhile, however, male green talent increased from 10.3% to 14.2% over the same timeframe (LinkedIn, 2022). In addition, between 2015 and 2021, men account for 66% of transitions into “green jobs”<sup>24</sup> and 63% of transitions into “greening jobs”<sup>25</sup> (LinkedIn, 2022). Despite these global trends, the LinkedIn (2022) report notes that certain European countries, such as Cyprus, Denmark, Ireland, Malta and the Netherlands, are among those countries with the fastest reduction in employment gender gaps due to their female green talent rising faster than their male green talent. However, no further explanation is provided with regard to the factors and measures that may have contributed to this change.

<sup>23</sup> A total of 38,000 skills listed on LinkedIn members’ profiles have been standardised by LinkedIn expert taxonomists. Out of this total, green skills have been delineated and defined as skills that enable the environmental sustainability of economic activities (LinkedIn, 2022). The approach of using social media for ‘nowcasting’ has been applied in studies commissioned by the European Commission with regard to policy areas in which there is a time lag in the availability of up-to-date data sources (e.g. in migration studies). See, for instance, Gendronneau et al. (2019). As the LinkedIn data report applies a nowcasting approach, we have included these analyses in our findings. However, it must be noted that LinkedIn data may be biased geographically and professionally, with highly skilled workers from the global North more likely to have LinkedIn profiles than workers with low and medium skill levels who are based in other locations.

<sup>24</sup> The LinkedIn (2022) report defines “green jobs” as those that cannot be performed without extensive knowledge of “green skills”. “Green skills” are, in turn, defined as skills that enable the environmental sustainability of economic activities.

<sup>25</sup> The LinkedIn (2022) report defines “greening jobs” as jobs that can be performed without “green skills”, but which typically require some “green skills”.

Figure 3. Change in EU labour force, absolute difference from baseline, 000s



Source: Cedefop (2021), based on the Cedefop skills forecast, 2020 baseline and European Green Deal scenario estimates.

The anticipated increase in job creation in green industries, with the aim of achieving the targets of the EU Green Deal (for instance, within the renewable energy sector), will be concentrated in sectors such as engineering, construction, electricity supply and recycling, and will require advanced skills in STEM (Science, Technology, Engineering and Mathematics). These sectors traditionally have a higher share of male employment; thus, the green transition will further benefit male workers in these sectors (Cedefop, 2021a). At the same time, however, green policies that aim to curb climate change have a negative affect mostly on employment in carbon-intensive heavy industries and fossil fuel extraction (e.g. mining) – also sectors that have a male-dominated workforce (OECD 2021). It is estimated that 73% of total world job losses will be in the fossil fuel energy sector (OECD 2021). In addition, the highest jobs gains will be in transportation services and the construction sector, which also tend to be male-dominated (OECD 2021). In view of these forecasts, the analyses by Cedefop (2021) and the ILO (2019) suggest that most upskilling and reskilling will concern male workers (see also the section on age later in this chapter). However, given the expected fall in consumer activity between 2021 and 2026, the forecast provided by Cedefop (2021a) estimates that the service sector will also be negatively affected. This, in turn, will have a negative impact on women’s labour market participation, as the services sector has a higher share of female employment. This emphasises the need for women workers also to reskill in order to gain employment in growing economic sectors. This could be a challenge, given that these sectors tend to have a male-dominated workforce.

The increase in STEM-focused occupations highlights the importance of education and training provision that equips learners with STEM skills<sup>26</sup>. Since women are traditionally underrepresented in STEM-related education and training, and also have lower rates of entrepreneurship than men, this can act as a barrier hindering their labour market participation in growing economic sectors and occupations. This, in turn, may potentially slow down the development of new, green, low-carbon technologies (OECD, 2021). This underlines the need for those policy interventions focusing on skills development to take gender considerations into account, to prevent green transitions from accentuating gender inequalities (ILO, 2019b). The Cedefop (2021) report emphasises that policy interventions

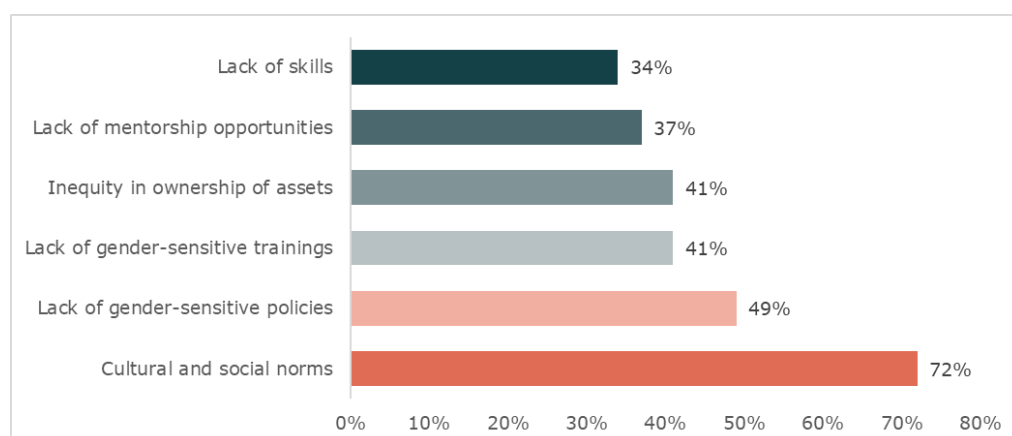
<sup>26</sup> As highlighted by Kwauk and Casey (2021), it is important not to conflate STEM skills with the green skills agenda.

are needed to attract more girls and women to follow education and training tracks such as engineering, which have traditionally been seen as male.

While not underestimating the importance to the green transition of STEM skills, or the underrepresentation of girls and women in STEM-related education and training streams, Kwauk and Casey (2021) point to the fact that green(er) skills represent a much wider scope than just core technical green(er) skills. These authors advise against a narrow approach that assumes because someone does not possess “technical skills rooted in STEM fields”, that such a person should be “inadvertently excluded by and from ‘skills for green jobs’” (Kwauk and Casey, 2021:30). At the same time, the authors note that even for women with STEM skills, the gender gap persists in industries and careers within the green sector, with women being underrepresented in both technical and leadership roles, the latter resulting in lower levels of pay. To this end, the green transition towards climate neutrality may be accelerated by addressing existing broader structural barriers to women’s participation in the labour market, facilitating their career development and ensuring a higher proportion of women in leadership roles.

Indeed, it appears that the underlying barriers to women’s participation in the green economy are much wider than just a lack of skills. The results of the IRENA (2019) study – a global survey of gender and renewable energy – show that cultural and societal norms, combined with a lack of gender-sensitive policies, training and mentorship opportunities and inequity in the ownership of assets, were perceived as more important barriers than a lack of skills (see Figure 4. Barriers to women’s participation in renewable energy jobs). In this respect, focusing predominantly on technical change (in this case, the acquisition of technical skills) may result in a scope that is too limited to achieve the desired impact. Allwood (2022) and Kwauk and Casey (2021) argue that a more efficient approach would be to focus on wider social transformation through structural and systemic changes, to address the structural causes of gender inequalities. To this end, the authors suggest centring gender in discussions regarding green jobs and in green learning agendas<sup>27</sup>. Further discussion of this perspective is outside the scope of this paper, however.

*Figure 4. Barriers to women’s participation in renewable energy jobs*



Source: IRENA (2019), cited by Kwauk and Casey (2021).

Note: Respondents were asked to select three barriers to women’s engagement in deploying renewables to expand energy access. The percentages represent the share of respondents who selected a specific measure as one of their top three.

<sup>27</sup> For instance, Kwauk and Casey (2021:37) note that “While there are rampant calls for greening TVET— which has emerged as a key focal point for stakeholders interested in the green economy—there has been insufficient attention on reforming TVET to become more gender transformative in an effort to ensure the manifestation of a greener economy is equitable and just.”

The sources reviewed suggest that further investment is needed in IVET and LLL, while increasing the participation of girls and women in STEM at secondary and tertiary education levels. Initiatives and measures that could attract more women towards STEM education and careers in green sectors include targeted information campaigns across different levels of education; the creation of mentoring programmes (see Box 3. Importance of mentoring and professional networking to combat gender gaps); providing girls and women with academic and industrial research scholarships; and opportunities for vocational apprenticeships (OECD, 2021, citing IRENA, 2013). In addition, accessible and targeted career guidance with an awareness-raising component has also been identified as playing a crucial role in attracting both women and men to green(er) jobs. For women, such career guidance provision could also contribute to overcoming negative gender stereotypes (e.g. some jobs being perceived as “male” occupations/sectors). Boosting awareness of and expanding the availability of and access to VET provision for green(er) skills would be beneficial from (at least) two perspectives: (1) providing opportunities to vulnerable and disadvantaged groups (including women) would strengthen and level up their socio-economic position; and (2) addressing green(er) labour market demands would contribute to the strengthening of and progress towards the achievement of the targets of the European Green Deal (Cedefop, 2022). Further examples of practices and measures that targeting women and promote skills acquisition in traditionally male-dominated occupations and sectors are presented in Box 3 and Box 4 below.

*Box 3. Importance of mentoring and professional networking to combat gender gaps*

Evidence shows that education and training are critical for equipping women with the qualifications needed to compete in the renewable energy sector. However, a study by Allison et al. (2019) focusing on women in these sectors in the United States and Canada shows that the strong social bonds of a mentoring network which provides women in STEM with a space for professional development and career success are critical to overcoming the gender gap in these industries.

An example of one such programme is the Women into Construction initiative, which was set up remotely in March 2020 in the UK. A total of 40 mentors have signed up to share their expertise and experiences via this initiative, with the aim of attracting other women into the construction sector, which traditionally has a very male-dominated workforce.

Source: <https://women-into-construction.org/wic-launch-successful-remote-mentoring-programme/>

*Box 4. Women Can Build*

**‘Women Can Build’:** this project was carried out in Belgium, France, Germany, Italy, Portugal and Spain, with the aim of raising awareness and advocating for equal opportunities in the building sector. The project ran from 2017 until 2020, and was implemented via access to MOOCs (Massive Open Online Course) focusing on gender awareness, a learning-on-the-job model with the aim of creating a zero-energy house, and the offering of mentoring to women in the sector. The project aimed to create a collection of good practices that could be transposed to multiple Member States across the continent.

A monitoring strategy was implemented throughout the project’s lifespan, through a combination of surveys and interviews. The outcomes of the project were positive, and led to the creation of a roadmap for gender mainstreaming in the construction sector.

Source: <https://www.womencanbuild.eu/fr/le-projet/>

### 3.4. Age

As noted in Chapter 2, the prevalence of green(er) jobs will increase in the future, and will consequently have a great impact on workers of all ages. However, the underlying factors that influence access to green(er) skills and the potential impact of the green transition will differ according to a worker's age. The available evidence indicates that young(er) workers are likely to benefit from the increase in green(er) jobs, particularly because they have grown up with a green component in their education (UNESCO, 2021). Furthermore, many programmes in Member States are aimed at helping young(er) workers to gain access to employment, particularly through apprenticeships (Cedefop, 2021b). The number of people starting apprenticeships has increased in several European countries (including the UK and Finland) (Cedefop, 2021b), with the beneficiaries of these schemes usually aged 25 and below (see Box 5). The importance of having green(er) skills programmes for young people is self-evident, as they will be the ones most impacted by climate change and future changes in skills demands. However, it is clear that the transition will also impact older<sup>28</sup> workers in the short to medium term. Immediate measures such as early retirement are mentioned; however, the OECD advises caution over such methods, as the phasing out of entire industries could lead to pressure on pensions (OECD, 2021). The OECD does not view early retirement schemes as a solution, but instead encourages public awareness campaigns to combat age-based discrimination in the labour market.

#### *Box 5. Tran Hung Dao Vocational College, Vietnam*

**Tran Hung Dao Vocational College, Vietnam:** this college trains farmers in clean production to improve their productivity and develop the ability to export clean produce (Maclean, 2018). The short-term training courses provided under its rural training policy strategy bring in experts from the Vietnam National University of Agriculture and the Bristol Research Institute of Agriculture to consult on curriculum development and technology. The courses offered by the college are in great demand among rural youth and farmers in Vietnam, as learners see the training provided as a step towards enabling their farming to become more sustainable.

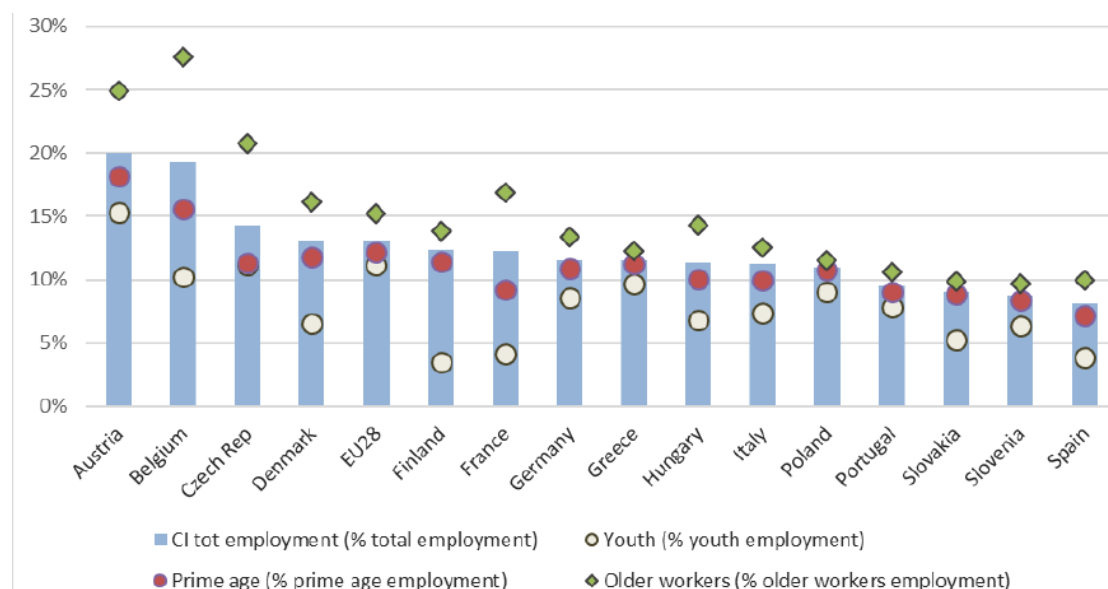
Source: Maclean, 2018.

Older workers (will) face a different set of challenges. First, they are less likely to gain access to reskilling programmes, especially those funded by employers, as there will be a shorter period of time during which retrained workers will deliver a return on the training investment (OECD, 2021). Once reskilled, older workers may be required to take jobs with a lower level of seniority than that they enjoyed previously, which may have a potentially negative impact on salary. Furthermore, older workers are over-represented in carbon-intensive industries; thus, the shift to a low-carbon economy is likely to have a particularly strong negative impact on them (OECD, 2021). The locations of these industries is also likely to exacerbate any issues. Many extractive industries are based in Central and Eastern Europe (e.g. Czechia, Poland and Slovakia) (see Figure 1Figure 5), and form vital parts of regional economies (OECD, 2021). Moreover, there is no guarantee that jobs lost in one region will be replaced in the same region, as renewable energy sources such as wind and solar need to be placed in specific geographies to maximise their utility (OECD, 2021). Older workers are also likely to be less willing to relocate.<sup>29</sup>

<sup>28</sup> The OECD uses the term "older" in its report. It does not define exact age groups, but appears to imply that older people are those who already have a career.

<sup>29</sup> Findings relating to the locations of jobs have been included in this section because most sources discuss the regional/geographical dimension in the context of an ageing population. We note that the regional points mentioned in this section may also be applied to other demographic aspects, such as the size of minority populations, or the inflow of workers internationally to traditional industrial regions. However, our literature search did not identify sources that directly discussed such aspects.

Figure 5. Employment in carbon-intensive industries as a share of total employment for different age cohorts, 2018



Source: OECD (2021), based on Eurostat data.

The sources reviewed for this report show evidence that the provision of green(er) skills education and training already focuses on the younger generation. Across Member States, there is a trend towards adapting curricula and increasing teaching about climate issues and green(er) skills. For instance, in Finland, climate change issues are included in education, with sustainable development being part of Finland's compulsory basic education system. Similarly, in France, climate and energy were introduced as topics into secondary schools in 2009 (UNESCO, 2021). In Sweden, all levels of education, including adult education institutes, have a clear remit to understand the requirements of sustainable development. Nevertheless, the in-depth teaching of climate issues is most common in secondary schools. This reflects a Europe-wide trend in which young people have greater access to knowledge about environmental issues. As a result, the cohorts of (future) younger workers already have an awareness of green labour market transitions, and have been provided with opportunities to acquire green(er) skills as part of their compulsory education. The availability of dedicated programmes for young NEETs (those not in employment, education or training) can provide additional support to young(er) generations in finding employment in green(ing) sectors (see Box 6). However, as suggested in the OECD (2021) report, more effort is still needed to raise awareness among young(er) learners about the green transition and emerging career opportunities. The report suggests that education curricula and career counselling services should provide up-to-date and wide-ranging information to expand and enrich the career aspirations of children and adolescents.

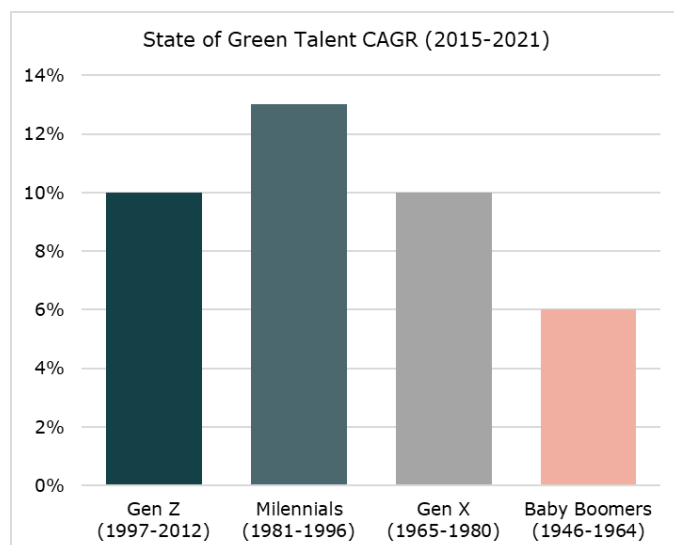
#### Box 6. Best practice: Fit4Green&Build

**Fit4Green&Build:** this programme in Luxembourg is offered as a series of training programmes, followed by a trainee contract with participating companies in the construction sector (EC PES network, 2021a). This contract is subsidised, with up to 50% of the salary being covered for 12 months, with the aim of the trainee being offered a full-time contract at the end of this period. The target group for this project is 18-29 year olds not in employment, education or training. The programme began in 2018 and is ongoing; however, evidence regarding its effectiveness is still unavailable.

Source: EC PES network (2021a).

Programmes targeted at young(er) people are likely to increase the advantage such age groups already have in acquiring green(er) skills. This is reflected in the data, which show that the largest growth in green talent between 2015 and 2021 has occurred among millennials (defined as having been born between 1981 and 1996), with 13% compounded annual growth (see Figure 6) (LinkedIn, 2022). Baby boomers (defined as having been born between 1946 and 1964) are the generation in which the smallest growth is seen, at 6% during the same period.

*Figure 6. Annual growth in the share of green talent among age groups, country average 2015-2021*



Source: LinkedIn (2022).

Apprenticeships have long served as vital programmes for vocational education. This is likely to continue as the need for retraining and upskilling becomes ever more prevalent. While many current apprenticeships are unrelated to green skills, as the need for a green transition becomes ever more important, they will need to be adapted to reflect this new reality. As noted in the Cedefop (2021b) report, there is already an increase in participation in apprenticeships by adults (defined as those aged 25 and over) due to policy interventions and a reduction in barriers to access; however, it is also noted that apprenticeships need to better reflect the various needs of adults, as they will come into the apprenticeship with a (far) longer history of work experience, which should be taken into account. Furthermore, adult apprentices are likely to require less supervision and intervention from their employers, due to their greater maturity and broader work- and life-experience (Cedefop, 2021b). However, older workers are likely to have higher living costs and may therefore need a higher salary, which may prove a challenge for the providers of apprenticeships, making employers more reluctant to hire them (CEDFOP, 2021b).

As already mentioned, one of the key barriers to older workers gaining access to training programmes supported by employers is that the employers will have a far shorter period of time to recoup their investment (OECD, 2021). This is especially stark in comparison to younger workers who are still many decades away from retirement age. In addition, when older workers are unemployed, they face longer durations without employment and larger wage losses once they are re-employed. There is also a cultural bias against hiring older workers, as they have fewer years of work left, therefore reducing the potential returns on investing in new skills (OECD, 2021). This could hinder the transition to green(er) jobs in the short term.

To combat this challenge, the OECD (2021) report suggests that public awareness campaigns should be launched to address age-based discrimination in the promotion of

educational programmes and in recruitment to them. Furthermore, the report also suggests that countries should gradually move away from mandatory retirement age as a ground for dismissal, as well as other age-based rules (OECD, 2021). An example of a programme that targets older workers is presented in Box 7.

*Box 7. Best practice – “Perspective 50plus” programme from Germany*

**“Perspective 50plus” programme:** this programme was first introduced in 2005 to reduce rate of early retirement and to provide funds to support the activation and labour market integration of older workers.

Regional organisations were given wide discretionary powers over designing their programmes, and the funding could be used for skill development activities, profiling, information campaigns, the promotion of internships, wage subsidies as well as innovative measures to address geographical discrepancies in supply and demand for jobs.

The programme led to a series of regulatory changes:

- Initially, a combination wage scheme for short-term unemployed older workers was introduced, with the objective of encouraging unemployed people to rapidly restart employment. If a new role pays a lower wage than their previous occupation, the government funds salary compensation for up to two years.
- An integration subsidy was established, targeting workers aged 50 and over. Hiring subsidies directed at employers cover up to 50 % of the labour costs for up to three years.
- The funds available for continuing training for older workers were expanded. Job holders aged 45 and over can receive continuing vocational training grants, and unemployed older people are entitled to education vouchers.
- To further encourage companies to employ older people, employment under fixed-term contracts was encouraged for people aged 52 and over. As opposed to other fixed-term contracts, the employer does not have to present an objective reason for the limitation of the duration of employment.
- As a further measure, the federal programme “30,000 Additional Jobs for Those over 58” created work opportunities with additional compensation of expenses for unemployed older people.

This programme is not explicitly aimed at the green transition; however, green(er) jobs are advertised on the programme’s platform. Furthermore, it is possible to offer training courses related to green(er) skills through the programme.

Source: <https://euagenda.eu/upload/publications/untitled-278483-ea.pdf>

The overrepresentation of older workers in those sectors that will be most impacted by the green transition is another important factor related to accessing green(er) skills education and training (OECD, 2021). Furthermore, the jobs that may disappear in carbon-intensive heavy industries and fossil fuel extraction activities are clustered in resource-rich regions of Member States (ILO, 2018). This geographic variation is of crucial importance to education and training, as well as to employment policy design and implementation at both national and regional levels. There is a specific need for re-training and re-skilling policies and programmes in regions with sizeable employment in coal mining and/or traditional vehicle manufacturing, such as in Greece where a Green VET campus has been set up in a coal mining area, and in Germany where Siemens’ in-house education and training seeks to focus on sustainability and the climate (Cedefop, 2022). Evidence suggests that a number of reskilling and re-training programmes have been implemented in these regions over recent years. See Box 8 and Box 9 for examples of strategies undertaken at national and regional levels. Some labour imbalances are also being addressed through active labour market policies and social protection measures, with skills intelligence tools (such as taxonomies, frameworks and toolkits) being used to prepare for labour market adjustments.

*Box 8. Best practice – Toolkit for ecological transition in France*

**Toolkit for ecological transition in France:** the development of this toolkit took place in 2015, and was based on local experiments in three regions. One of its tools identifies occupations at risk in the context of economic restructuring, and “green” or “greening” occupations in the local area.

The toolkit identified a series of professions that were at risk within a particular region, and also identified a list of greening professions in the same region. Using the PES occupational classification system, a description of the tasks, qualifications and competences was compiled, along with current and future employment prospects. This is then used as a pathway to occupational transition. It is also indicated if training for the new occupation can be carried out within the local area.

Examples of identified pathways included:

- From industrial maintenance agent to sanitation technician; and
- From metal production operator to pipe-layer.

Initial assessment of results of this project was positive, therefore the French government has decided to continue running it.

For more information, refer to: <https://www.ecologie.gouv.fr/laccompagnement-des-transitions-professionnelles>

Source: EC PES, 2021a.

*Box 9. Best practice: local development strategy for moving away from coal*

**Local development strategy for moving away from coal in the Jiu Valley, Romania:** developed in 2020, this strategy seeks to define the development priorities for the region as it moves away from intensive extractive activities. The strategy focuses on:

- the modernisation of infrastructure;
- improving environmental protections by reducing emissions; and
- the ecological rehabilitation of areas impacted by intensive economic activities.

The strategy is part of an overall plan for the region, but further plans are envisaged at municipal level within the region. These include investments in improving education and recommendations on how to move away from extractive industries, such as primarily focusing on the development of micro-farms which build on local traditions, with a secondary priority being to exploit renewable energy sources.

This plan has not yet been implemented. It is therefore not possible to assess whether it has been effective.

Source:

[https://ec.europa.eu/energy/sites/ener/files/documents/jiu\\_valley\\_regional\\_profile\\_-\\_start\\_technical\\_assistance.pdf](https://ec.europa.eu/energy/sites/ener/files/documents/jiu_valley_regional_profile_-_start_technical_assistance.pdf)

### 3.5. Skill levels and occupations

The evidence reviewed provides inconclusive findings regarding the impact of the green transition on various skill levels. This partly results from the differing definitions of green(er) skills and jobs (narrow vs. wider focus), and the temporal perspectives adopted in research studies (analysis of the current situation vs. future labour market trends and needs).

Analysis by Cedefop shows that the European Green Deal will increase overall employment levels, with pronounced growth across the skills spectrum and occupational categories. The creativity and innovation of highly skilled workers will be necessary for climate technology breakthroughs. Highly skilled non-manual workers (e.g. scientists, engineering professionals) and supporting staff (e.g. business, administration and legal professionals) will be important for driving and implementing European Green Deal transitions. With many

green investments now reaching the operational stage, personnel needs are being forecast across all skills levels. In fact, Cedefop's projections for employment by skills level between 2020 and 2030 show that employment in skilled manual and elementary occupations is expected to grow faster than in high-skilled occupations. This could be a positive pattern, as green transitions in the labour market may alleviate rather than exacerbate job polarisation in Europe (Cedefop, 2021a). A similar observation was made in a report by the ILO (2019), which assessed that up to 2030, job creation globally would be concentrated among medium-skill occupations.

*Table 2. Changes in skills by occupation*

Skill level	Nature of change	Typical skills response
<b>Low-skilled occupations</b>	Occupations change in a generic way, e.g. requiring increased environmental awareness or simple adaptations to work procedures	On-the-job learning or short reskilling and upskilling programmes
<b>Medium-skilled occupations</b>	Some new green(er) occupations Significant changes to some existing occupations in terms of technical skills and knowledge Most new green(er) occupations will fall into this category	Short to longer upskilling and reskilling programmes; TVET courses
<b>High-skilled occupations</b>	Significant changes to some existing occupations in terms of existing and new knowledge	University degree; longer upskilling programmes

Source: ILO (2019a, 2019b0).

However, a study by Marin and Vona (2018) based on an analysis of 15 industrial sectors in 14 European countries concluded that there would be an increase in jobs biased towards professionals (Marina and Vona, 2018). Similarly, analysing current green(er) occupations in the USA, Consoli et al. (2015) found that these occupations were characterised by higher levels of non-routine cognitive skills, and also had a greater dependence on formal education, work experience and on-the-job experience. However, it must be noted that this study analysed the situation at the time the analysis was carried out, and not future trends. It is possible that labour market demands for high-skilled occupations to become green(er) are already being detected in the labour market data, whereas such demand among low- and medium-skilled occupations is only starting to appear, and is thus not yet so pronounced.

The finding that green transitions in the labour market are diffuse and will rely on workers across all skills levels and occupations is important from a policy perspective. It indicates that skills training and the provision of reskilling and upskilling programmes is required at all skill levels (see Table 2 for a summary of changes and typical skills responses). Identification of skill needs through skills intelligence, such as skills taxonomies and frameworks, is the first step in finding sectoral, occupational and skill level gaps (Cedefop, 2021a; UNESCO, 2021). This will then facilitate the creation of effective VET and LLL programmes to fill any potential gaps. Examples of such approaches and programmes are presented in Box 10 and Box 11.

*Box 10. Best practice –vocational training in Denmark*

**Danish Advisory Council for Initial Vocational Training:** in Denmark, the Advisory Council for Initial Vocational Training (established in 2007 under the Vocational Education and Training Act) was appointed by the Minister of Education to continuously update the competences to be provided by the vocational education and training system. The Council works with around 50 trade committees that include representatives from trade unions and employer organisations. Furthermore, in its 2014 strategic plan the Council for Adult and Further Education underlined the need to focus on special competencies relating to energy optimisation and sustainability. Related to this, a large number of adult labour market training programmes are offered in the areas of energy, environment and waste handling.

Sources: <https://www.uvm.dk/erhvervsuddannelser/ansvar-og-aktoerer/raad-og-udvalg/reu/om-reu>; <https://www.european-agency.org/sites/default/files/dk-policy-summary-report.pdf>

*Box 11. Best practice –TVET system in Germany*

**Building up skills in Germany:** Germany is well known for its TVET system and plans to use this to help in its transition to a greener economy. Within this system, the private sector plays a vitally important role in skills training. Regular dialogue occurs between the public and private sectors to ensure that TVET programmes and qualifications are revised to reflect current needs, particularly greening elements. The importance of the TVET system is explicitly recognised in Germany's Climate Action Plan 2050 (published in 2016), which seeks to improve climate education throughout the entire educational chain, integrate training and education on climate change into funding streams, and promoting community participation.

Source:  
[https://www.bmuv.de/en/publication?tx\\_bmubpublications\\_publications%5Bpublication%5D=396&cHash=21a83ca91c7188605d8d0ff273fb5e95](https://www.bmuv.de/en/publication?tx_bmubpublications_publications%5Bpublication%5D=396&cHash=21a83ca91c7188605d8d0ff273fb5e95)  
<https://www.bmuv.de/en/topics/education-participation/education/education-service-what-is-it-about>

The level of change necessary for jobs to become green(er) will depend on the existing skills levels in particular occupations. The ILO states that low-skilled occupations will change in a generic way, requiring increased environmental awareness or simple adaptations to work procedures rather than the learning of entirely new skills (2019b). As a response, the ILO recommends a mix of on-the-job learning or short reskilling and upskilling programmes (ILO, 2019b). For medium-skilled occupations, the situation is more complex. This is because there are likely to be new green(er) occupations and significant changes to certain occupations in terms of the technical skills and knowledge required (ILO, 2019b). It is clear that more significant changes will require a greater skills' response. This will involve short- to longer-term upskilling and reskilling programmes or TVET courses (ILO, 2019b). These courses will require more funding and resources than those aimed at low-skilled workers, but the sources reviewed do not provide further detail on the likely funding routes. An example of a TVET course from Spain is presented in Box 12.

*Box 12. Best Practice: the greening of TVET in Spain*

**Greening of TVET in Spain:** since 2010, Spain has been taking measures to "green" its TVET diplomas, while also developing entirely new diplomas specifically for green(er) jobs. By mid-2017, there were 21 TVET diplomas dedicated to green(er) jobs, of which 17 had been created since 2010. Furthermore, there were also 78 new diplomas that included content that responded to green criteria, and 35 diplomas that included

transversal green content (ILO, 2019a). It should be noted that in 2022, Spain carried out a major reform of its VET system. This reform was designed to work alongside Spain's Sustainable Development Goals, which form part of the country's 2030 agenda. More information: <https://www.cedefop.europa.eu/en/news/spain-vet-revolution>

Similar findings have been made in the US. Analysing data from the US O\*NET database, Bowen et al. (2018) found that just under 20% of US workers can be considered part of the green economy in a broad sense. However, many of these jobs would be "indirect green jobs", meaning that they will not require significant changes in tasks, skills or knowledge. The authors conclude that most retraining should be possible on the job, as green(er) jobs typically differ from non-green jobs in only a few skill-specific aspects. This is very similar to the finding of the ILO.

It must also be noted that unemployment rates among low-skilled workers in many Member States are often already high. Taking Spain as an example, those with low education levels suffer the highest level of unemployment, making up 55.6% of those unemployed in 2017 (Cedefop, 2018). To help those from disadvantaged groups to move into sustainable job in the future, Spain has a wide-ranging programme, outlined in Box 13.

*Box 13. The Emplea Verde Programme in Spain*

**Spain's Emplea Verde Programme:** this programme aims to promote the employment and competitiveness of the private sector through environmental transformation and greening. To this end, one of its targets is to improve workers' skills. Since 2007, 1,900 courses have been provided in green skills. Between 2014 and 2022, the programme provided funding for 4,800 previously unemployed people to join the labour market, and allowed 24,000 people to obtain qualifications.

Emplea Verde prioritises certain groups of citizens such as women, workers in rural and environmentally protected areas, workers over the age of 45, persons with low levels of education, migrants and (recently) young persons under 30 years of age.

More information: [https://www.cedefop.europa.eu/files/spain\\_green\\_jobs\\_2018.pdf](https://www.cedefop.europa.eu/files/spain_green_jobs_2018.pdf)

For high-skilled occupations, there are likely to be significant changes in terms of technical skills and knowledge (ILO, 2019b). In response, this will require more extensive retraining involving university degrees and longer upskilling programmes (ILO, 2019b). This will ultimately lead to a requirement for more complex skills such as:

- Analytical thinking (including risk and systems analysis) to interpret and understand the need for change and measures required; and
- Coordination, management and business skills that can encompass holistic and interdisciplinary approaches incorporating economic, social and ecological skills (ILO, 2019b).

Analysis by Cedefop found that in computer programming specifically, there will be a great demand for highly skilled workers, which could be interpreted as evidence of the links between the digital and the green transitions (2018). Furthermore, a greater number of new professions will be created, compared with other skill levels (ILO, 2019b). Examples of these include agricultural meteorologists and carbon trading analysts (ILO, 2019b). The creation of entirely new professions will require more extensive learning to acquire the necessary skills, and these new skills will require recognition. An example of this is shown in Box 14. Box 15, meanwhile, shows an example of an accompanying measure.

*Box 14: British Columbia, Canada – the Workforce Readiness Framework*

**Workforce Readiness Framework:** as part of its Just Transition Monitoring and Evaluation Programme, as of 2022 the government of British Columbia (BC) is developing a framework with employers to ensure that the workforce will be ready for a more sustainable future. This will include measures to ensure BC possesses the number and diversity of workers necessary to meet employers' needs. It also aims to ensure opportunities for workers to upgrade their skills to adapt to changing jobs, as well as the new training programmes, standards and credentials for which workers and employers are increasingly looking as the region transitions towards a low-carbon economy. More information: <https://cleanbc.gov.bc.ca/>

*Box 15: An accompanying measure: the Estonian Unemployment Insurance Fund*

**Estonian Unemployment Insurance Fund:** this was adapted in 2017 to provide a wide range of services aimed at preventing unemployment. These new services are aimed at both employees and employers. The Fund helps employees to acquire new skills or to update skills that are no longer useful. It helps employers to find and train the workers they need for restructuring. Source: ILO 2019a.

## 4. Key findings, policy implications and recommendations

This chapter summarises the findings of this report and lays out its key policy recommendations.

### 4.1. Key findings and conclusions

The available evidence consistently highlights that workplaces are undergoing profound changes to adapt to and facilitate the green transition. There is a relatively good understanding of the overall direction of developments in the labour markets, and that these changes are conditional on adaptations in education and training provision. However, **until autumn 2022, there was no commonly adopted approach to defining green(er) jobs and skills** at either international or EU level. This means that **various agencies and governmental bodies have adapted existing definitions and developed their own approaches**. The sources reviewed indicate that **green(er) jobs will require a combination of soft and technical skills, as well as cross-cutting competencies**. This is reflected in the **new definition of 'skills for the green transition'** developed jointly by the Inter-Agency Working Group on Work-based Learning, which **focuses on technical and transversal skills**. Adopting and applying this definition consistently would foster greater definitional clarity and coherence. This, in turn, would also facilitate more targeted policy planning, implementation and evaluation, and enable comparative analysis.

In recent years, to understand current and future labour market trends and skills needs, a number of **green(er) jobs taxonomies and frameworks have been developed**. However, it **remains unclear how these efforts are being used in practice** to inform the development and implementation of education and training provision, as well as access to such provision. It must be noted that this could be because many of the concepts involved are very new, and therefore may not yet have had time to become widely adopted. There is also **scarcity of monitoring and evaluation data**, making it **difficult to make recommendations as to which approaches, policies and practices might be effective in facilitating access to education and training provision**.

Overall, the evidence indicates that the **green transition will have a neutral or slightly positive effect on employment** in the medium term, and that it **will affect all spheres**

**of society.** As such, this **will require a coordinated policy response** to address climate and environmental challenges as well as potential societal and economic inequalities at the same time. **This will require a more holistic approach, as well as a well-coordinated response and alignment across sectors and policy domains.** As yet, however, it appears that policies across these domains remain fragmented and lack coherence.

The sources reviewed also indicate that **greening in the labour market** will entail some social changes, and that **some groups may be particularly affected** (both negatively and positively). The evidence also points to **ongoing challenges relating to skills, education and training that may hinder green transitions and the benefits that can be achieved from them.** Key societal dimensions that affect unequal access include the gender, age and skill levels of workers. However, **the intersectionality of disadvantages across these dimensions often makes it difficult to disaggregate findings across specific axes of disadvantage.** In general, evidence suggests that **men are transitioning into green(er) jobs at a faster rate than women, but specific male-dominated sectors are also particularly negatively affected** by job losses due to green transitions. Since women are traditionally underrepresented in STEM-related occupations and leadership roles, this places **female workers at a disadvantage**, as many green(er) jobs require technical and managerial/leadership skills. **Older workers may also be at a disadvantage** due to having fewer education and training opportunities, and potentially experiencing occupational and seniority downgrading when reskilling. In addition, the greening of jobs and skills will also have an impact on **workers across the skill levels continuum, but the evidence is inconclusive** as to the specific short- and long-term directions of these impacts. Lastly, evidence suggests that policies aimed at boosting awareness of, as well as facilitating the availability of and access to VET provision in green(er) skills would strengthen and level up the socio-economic positions of workers and at the same time help to address labour market demands and support the achievement of wider green and sustainable policy targets.

#### **4.2. Policy recommendations**

Ongoing efforts to define green skills and green(er) jobs at international and EU levels have produced a set of definitions. Until recently (autumn 2022), the definitions used by various agencies were not harmonised, and emphasised different aspects. Definitions adopted at national level still vary, and determine what counts as a green skill and what types of jobs will require green skills, therefore creating challenges for international/EU policy planning and the implementation of measures. These diverse definitional approaches still make it difficult to compare between countries. Such differences also have an impact on how green(er) skills and jobs data are classified – and this, in turn, can act as an obstacle to systematically designing and implementing skills strategies, as well as identifying and planning education and training provision at EU level. **The development of a set of common international and European definitions in relation to green(er) jobs and skills is a step in the direction of a more common approach. Using this definition consistently across the EU Member States and internationally would facilitate a clear understanding of green policy priorities, and of concrete steps to implement them in order to achieve the anticipated results of a green transition to climate neutrality.** It would also facilitate the exchange of experience and the transfer of promising practices between countries.

Anticipating skills needs also requires the use of analytical concepts and frameworks to identify green(er) jobs and skills in different sectors. Responding to this challenge, international and EU agencies, as well as national authorities, have developed frameworks and taxonomies that systematically and comprehensively link demand for certain skills, and their supply, with jobs. However, **more research is needed into how we can make optimum use of such taxonomies and frameworks to understand needs and**

**trends, and whether and how these taxonomies may need to be adapted for better use by practitioners. EU and national government agencies would be best placed to commission such research and to implement the recommendations that result from such studies.**

Furthermore, recent efforts have also focused on quantitatively monitoring developments in green(er) skills and jobs. However, the **granularity and timeliness of data still pose a challenge**. Data disaggregation is possible, but is subject to certain limitations with regard to the level of detail available on particular demographic and socio-economic characteristics as well as and national, regional and local trends, with national-level data not always being available for all EU Member States. Such obstacles impede the process of differentiating between the specific needs of particular societal groups, and thus addressing these needs with an adequately designed, targeted educational and training provision that reflects the specific situations and needs of particular geographies. Furthermore, there is **a time lag in the provision of up-to-date information**, making such data more suitable for long-term planning and less able to respond to short-term provision needs. In this respect, **using social media data and 'nowcasting' methods** can offer the timely provision of up-to-date trends data on supply and demand for skills. As such, it **could support analytical efforts and policy responses at EU and national levels**. In addition, **relevant EU and national stakeholders should also implement monitoring and evaluation frameworks to assess how data are used, by whom, and to what effect – as well as and how the quality and availability of and access to data might be improved**.

All of these challenges – namely, those relating to definitional aspects and the availability and types of data available regarding green(er) skills and jobs – make it **difficult to assess whether, and to what extent, access to education and training provision for the green transition is just and equal**. In general, when adopting the perspective of skills demand, the available data might facilitate an understanding of current and future trends, including how skills demands change over time. This information, combined with data on skills supply across population groups, facilitates some understanding of which groups are at risk of being disadvantaged due to the green transition. However, **untangling whether these disadvantages are directly related to the green transition or due to other, wider factors** (e.g. structural factors, attitudes) **has proved challenging**. Our research has identified a number of examples of promising practices that support learners and workers in acquiring green(er) skills. Many of these practices directly address the specific needs of disadvantaged groups via targeted programmes, funding streams, on-the-job training and other methods. However, information is scarce regarding how easy or difficult it is to access such provisions, and whether there is any (systemic) disadvantage in getting access to provisions. Due to the **scarcity of information**, conducting a systematic filtering **of what works under which conditions also proved challenging**. Consequently, it is difficult to say with confidence whether these educational and training measures put in place by stakeholders meet the access needs of groups that may experience disadvantage and vulnerabilities resulting from green transitions. **Future actions at EU and national levels should focus on ensuring a coordinated and coherent policy response that takes into account the interrelationships between policy areas** (environmental and climate, with social, economic, financial, digital and innovation policies). **Policy actors should also closely coordinate their efforts with a broad range of stakeholders** to ensure the responsive and timely provision of education and training services that are accessible to all societal groups and which meet the short- and long-term needs of the labour market. **Stakeholders should also develop monitoring and evaluation frameworks, with clearly defined indicators, and assess policy implementation at regular intervals**. These monitoring activities should also include an assessment of the Green Deal and sustainability policy more widely. Additional attention should be paid to preventing the

implementation of short-term policies (e.g. in response to the COVID-19 pandemic and the Russia-related energy crisis) that are contrary to overall long-term green policy objectives.

With a lot of public spending invested in the recovery and stimulus packages in response to COVID-19 and the energy crisis, it is more important than ever to put in place an integrated approach that addresses all of the pressing challenges related to environmental and societal aspects. In progressing towards more sustainable and green policies and practices, however, it must be ensured that the provision of equal and just access to all population groups is the guiding principle of any policy action or practical measures, including those relating to skills, education and training.

## Annex A – Bibliography

### References

1. Allison, J.E., McCrory, K., & Oxnevad, I. (2019). Closing the renewable energy gender gap in the United States and Canada: The role of women's professional networking. *Energy Research and Social Science*, 55, 35-45.
2. Allwood, G. (2022). The EU's transition to climate justice and gender equality. How just and how equal. Policy Brief. FEPS Foundation for European Progressive Studies. [https://feps-europe.eu/wp-content/uploads/2022/06/FINAL\\_DIGITAL\\_21.6.22\\_How\\_just\\_and\\_how\\_equal.pdf](https://feps-europe.eu/wp-content/uploads/2022/06/FINAL_DIGITAL_21.6.22_How_just_and_how_equal.pdf)
3. Andersen A. et al. (2019). *Green growth in Nordic regions: Eight case studies*. Oslo: NIFU.
4. Bianchi, G., Pisiotis, U., & Cabrera Giraldez, M. In: Punie, Y., & Bacigalupo, M. (eds.), *GreenComp: The European sustainability competence framework*, EUR 30955 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-46485-3, doi:10.2760/13286, JRC128040.
5. Bowen, A., Kuralbayeva, K., & Tipoe, E. (2018). Characterising green employment: the impacts of "greening" on workforce composition. *Energy Economics*, 72. pp. 263-275. DOI: 10.1016/j.eneco.2018.03.015
6. Cedefop (2012). *Green skills and environmental awareness in vocational education and training. Synthesis report*, Research Paper No. 24.
7. Cedefop (2022). An ally in the green transition. Briefing note, March 2022. [https://www.cedefop.europa.eu/files/9166\\_en.pdf](https://www.cedefop.europa.eu/files/9166_en.pdf)
8. Cedefop. (2019a). *Identification of future skills need for the green economy*. Luxembourg: Publications Office of the European Union.
9. Cedefop (2019b). *Apprenticeship for adults: Results of an explorative study*. Luxembourg: Publications Office of the European Union.
10. Cedefop (2018). *Skills for green jobs: an update: Spain*. Luxembourg: Publications Office of the European Union.
11. Cedefop (2021a). *The Green Employment and Skills Transformation: Insights from a European Green Deal skills forecast scenario*. Luxembourg: Publications Office of the European Union.
12. Cedefop (2021b). *The next steps for apprenticeship*. Luxembourg: Publications Office of the European Union, 2021.
13. Consoli et al. (2015). Do green jobs differ from non-green jobs in terms of skills and human capital? *SEEDS Working Paper Series 10*.
14. Dierdorff et al. (2009). *Greening of the World of Work: Implications for O\*NET-SOC and New and Emerging Occupations*. United States of America: National Center for O\*NET Development.
15. ESCO, JRC Science for Policy Report (2022). *GreenComp: The European sustainability competence framework*. Luxembourg: Publications Office of the European Union.
16. European Commission (2019a). *Employment and Social Developments in Europe: Sustainable growth for all: choices for the future of Social Europe, Annual Review 2019*. Luxembourg: Publications Office of the European Union.
17. European Commission (2019b). *The Social Dimensions of "Greening the Economy"*. Luxembourg: Publications Office of the European Union.
18. European Commission (2020). *A Union of Equality: Gender Equality Strategy 2020-2025*, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions., COM (2020) 152 final § (2020). Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0152>.

19. European Commission (2021a). *European Network of Public Employment Services: Greening of the labour market – impacts for the Public Employment Services*. Brussels: European Commission.
20. European Commission (2021b). *Proposal for a regulation of the European Parliament and of the Council establishing a Social Climate Fund*. Brussels: European Commission.
21. European Commission (2022). *Report from the Commission to the European Parliament and the Council*. Brussels: European Commission.
22. European Commission, European Training Foundation, CEEFOP, OECD, ILO, UNESCO (EC et al.) (2022). *Work-based learning and the Green Transition*, Inter-Agency Working Group on Work-based Learning.
23. Government of British Columbia (2021). *cleanBC: Roadmap to 2030*. Victoria: Government of British Columbia.
24. International Labour Office (2015). *Anticipating skill needs for green jobs, A practical guide*. Geneva: International Labour Office.
25. International Labour Organization (2018). *Greening with jobs: World Employment Social Outlook 2018*. Geneva: International Labour Organisation.
26. International Labour Organization (2019a). *Skills for a Greener Future: A Global View*. Geneva: International Labour Organization.
27. International Labour Organization (2019b). *Skills for a Greener Future: Challenges and enabling factors to achieve a just transition*. Geneva: International Labour Organization.
28. IRENA (2019). *Renewable energy: A gender perspective*. Abu Dhabi: IRENA.
29. Kronsell, A. (2013). 'Gender and Transition in Climate Governance', *Environmental Innovation and Societal Transitions*, 7, pp. 1–15.
30. Kwauk, C., & Casey, O. (2021). *A new green learning agenda: Approaches to quality education for climate action*. Washington D.C.: Center for Universal Education at Brookings.
31. Leichenko, R., & O'Brien, K. (2020). Teaching climate change in the Anthropocene: An integrative approach. *Anthropocene* 30, 1-4. <https://doi.org/10.1016/j.ancene.2020.100241>.
32. LinkedIn (2022). *Global Green Skills Report*. USA: LinkedIn.
33. Maclean, R. et al. (2018). *Education and Skills for Inclusive Growth, Green Jobs and the Greening of Economies in Asia: Case Study Summaries of India, Indonesia, Sri Lanka and Viet Nam*. Singapore: ADB.
34. Marin, G. & Vona, F. (2018). Climate policies and Skill-biased employment dynamics: evidence from EU countries. *HAL Science*, ffh1-03458172f.
35. Moyer, J.M., & Sinclair, A.J. (2020). Learning for sustainability: Considering pathways to transformation, *Adult Education Quarterly*, Vol. 70 (4).
36. OECD (2017). *Boosting skills for greener jobs in Flanders*. Belgium: OECD Green Growth Series.
37. OECD (2021). *Green growth and sustainable development*. Paris: OECD.
38. Pavlova, A., & Singh, M. (2022). *Recognizing Green Skills Through Non-formal Learning: A Comparative Study in Asia*. Singapore: Springer.
39. Pavlova, M. (2018). Fostering inclusive, sustainable economic growth and "green" skills development in learning cities through partnerships. *Int Rev Educ* 64:339-354. <https://doi.org/10.1007/s11159-018-9718-x>
40. Pirgmaier, E., & Steinberger, J.K. (2019). Roots, riots, and radical change – A road less travelled for ecological economics. *Sustainability* 11.
41. Stevenson, R.B. (2006). Tensions and transitions in policy discourse: Recontextualizing a decontextualized EE/ESD debate. *Environmental Education Research* 12(3-4), 277–90.
42. Taylor, A., Nelson, J., O'Donnell, S., Davies, E., & Hilary, J. (2022). *The Skills Imperative 2035: What Does the Literature Tell Us about Essential Skills Most Needed for Work?* Working Paper 1. National Foundation for Educational Research.

43. UNESCO- UNEVOC (2021). *Skills development and climate change action plans: Enhancing TVET's contribution*. Paris: UNESCO.
44. UNESCO (2020). *Adult education and the challenge of exclusion*. UIL Policy Brief 10. Hamburg: UNESCO Institute for Lifelong Learning.
45. WEF (World Economic Forum) (2020). *Jobs of Tomorrow: Mapping Opportunity in the New Economy*.  
[https://www3.weforum.org/docs/WEF\\_Jobs\\_of\\_Tomorrow\\_2020.pdf](https://www3.weforum.org/docs/WEF_Jobs_of_Tomorrow_2020.pdf)
46. WCL (Wildlife and Countryside Link) (2021). *Changing the world from within. Understanding what is helping and hindering the environment sector from becoming more ethnically diverse*.  
[https://www.wcl.org.uk/assets/uploads/img/files/Changing\\_the\\_world\\_from\\_within\\_Sept\\_2021.pdf](https://www.wcl.org.uk/assets/uploads/img/files/Changing_the_world_from_within_Sept_2021.pdf)

## Additional sources

1. Cedefop (2022). *Championing the skills revolution*. Briefing note.  
<https://www.cedefop.europa.eu/en/publications/9164>
2. Chateau, H., & Mavroeidi, E. (2020). *The jobs potential of a transition towards a resource efficient and circular economy*. OECD Environment Working Papers No. 167.
3. Council of the European Union (2022). *Council Recommendation on ensuring a fair transition towards climate neutrality*, Brussels, 7 July 2022.  
<https://data.consilium.europa.eu/doc/document/ST-9107-2022-INIT/en/pdf>
4. Chen, Z., Marin, G., Popp, D., & Vona, F. (2020). *Green Stimulus in a Post-pandemic Recovery: the Role of Skills for a Resilient Recovery*. *Environmental and Resource Economics*, 76:901–911 <https://doi.org/10.1007/s10640-020-00464-7>
5. European Commission Joint Research Centre (2021). *The Future of Jobs is Green*. Luxembourg: Publications Office of the European Office.
6. European Commission (2019). *Communication from the Commission to the European Parliament, the European Council, the Council, The European Economic and Social Committee and the Committee of the Regions: The European Green Deal*. Brussels: European Commission.
7. European Commission (2021). *Education for environmental sustainability: policies and approaches in European Union Member States* Final Report, Brussels: European Commission.
8. European Commission (2022). *Green Skills and Knowledge Concepts: Labelling the ESCO classification, Technical Report*. Brussels: European Commission.
9. European Commission (2021). *Labour Markets and the Green Transition: a practitioner's guide to the task-based approach*. Luxembourg: Publications Office of the European Union.
10. European Commission (2021). *Making sustainable use of our natural resources, Nature factsheet*. Brussels: European Commission.
11. European Commission (2019). *Reflection Paper: Towards a sustainable Europe by 2030*. Brussels: European Commission.
12. European Commission (2021). *Social Situation Monitor: Quality of Green Jobs*. Luxembourg: European Commission.
13. European Commission (2019). *Socially fair transition to a green economy*. Social Situation Monitor Seminar. Brussels: European Commission.
14. Gambhir, A., Green, F., & Pearson, P. (2018). *Towards a just and equitable low-carbon energy transition*. *Grantham Institute Briefing paper No 26*. London: Imperial College London, 2018.
15. Gendronneau, C., Wisniewski, A., Yildiz, D., Zagheni, E., Florio, L., Hsiao, Y., Stepanek, M., Weber, I., Abel, G., & Hoorens, S. (2019). *Measuring labour mobility and migration using big data*. DG Employment, Social Affairs and Inclusion.

16. Holm, T., Vennervirta, P., Pöykkö, T., Hämeenoja, E. & Teirasvuo, N. (2017). Identification of Skills Needed for Central Areas of Green and Low-Carbon Economy, for the Needs of Labor Market in Finland, *European Journal of Sustainable Development Research*, 1:1, 5. <http://dx.doi.org/10.20897/ejosdr.201705>
17. Kwauk, C., & Casey, O. (2021). *A new green learning agenda: Approaches to quality education for climate action*. Washington D.C.: Center for Universal Education at Brookings.
18. Martinson, K., Stanczyk, A., & Eyster, L. (2010). *Low-Skill Workers' Access to Quality Green Jobs*. Washington D.C.: The Urban Institute.
19. Miler, T., & Sladek, P. (2010). The climate literacy challenge. *Procedia Social and Behavioral Sciences* 12, 150-156. doi:10.1016/j.sbspro.2011.02.021
20. NESET (2021). *Potential Policy Directions in Education. Analysis of EU Policy documents and priorities*, Teasers collection. Brussels: European Commission.
21. OECD (2017). *Employment Implications of Green Growth: Linking jobs, growth, and green policies: OECD Report for the G& Environment Ministers*. Paris: OECD.
22. OECD (2021). Think green. Education and climate change. Trends shaping education. Spotlight #24. <https://www.oecd-ilibrary.org/docserver/2a9a1cdd-en.pdf?expires=1666345392&id=id&accname=guest&checksum=2E1EAC3F5BFD57979881DF9626D628B5>
23. Pociovălișteanu et al. (2015). Employment Policies for a Green Economy at the European Union Level. *Sustainability* 2015, 7, 9231-9250. doi:10.3390/su7079231
24. PwC, *Green Jobs Barometer: Monitoring the fair transition to a green economy*. London: PwC, 2021.
25. Rose, A.D. (2013). From Policy to Training: The Conundrum of Green Jobs. *Adult Learning*, 24(1), 47-49. <https://doi.org/10.1177/1045159512467779>
26. Scully-Russ, E. (2013). Are Green Jobs Career Pathways a Path to a 21st-Century Workforce Development System? *Adult Learning*, 24(1), 6-13. <https://doi.org/10.1177/1045159512467323>
27. The Century Foundation (2019). *Redefining Green Jobs for a Sustainable Economy*. Washington D.C.: The Century Foundation.
28. UC Berkeley Labor Center (2020). *Putting California on the High Road: A Jobs and Climate Action Plan for 2030*. Berkeley: UC Berkeley.
29. UNESCO (2019). *4th Global Report on adult learning and education*. Hamburg: UNESCO Institute for Lifelong Learning.
30. Vaquero, M. G., Sanchez-Bayon, A., & Lominchar, J. (2021). European Green Deal and Recovery Plan: Green Jobs, Skills and Wellbeing Economics in Spain. *Energies*, 14, 4145. <https://doi.org/10.3390/en14144145>
31. Vona, F. (2019). *Skills for the Green Economy: What, Where and How Much?* OFCE Sciences-Po research seminar. Brussels: European Commission.
32. Vona, F., Marin, G., Consoli, D., & Popp, D. (2018). Environmental Regulation and Green Skills: An Empirical Exploration, *Journal of the Association of Environmental and Resource Economists* 5,4. <https://doi.org/10.1086/698859>
33. Wals, A., & Benavot, A. (2017). Can we meet the sustainability challenges? The role of education and lifelong learning. *Eur J Educ.* 00:1-10. <https://doi.org/10.1111/ejed.12250>
34. WEF (World Economic Forum) (2021). Building a common language for skills at work. A global taxonomy.

### **Finding information about the EU**

#### Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: [https://europa.eu/european-union/index\\_en](https://europa.eu/european-union/index_en)

#### EU publications

You can download or order free and priced EU publications at:  
<https://publications.europa.eu/en/publications>. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)).



Publications Office  
of the European Union