CEDEFOP
European Centre for the Development of Vocational Training

EN

THE GREEN EMPLOYMENT AND SKILLS TRANSFORMATION

Insights from a European Green Deal skills forecast scenario

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The green employment and skills transformation

Insights from a European Green Deal skills forecast scenario

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The **European Centre for the Development of Vocational Training** (Cedefop) is the European Union's reference centre for vocational education and training, skills and qualifications. We provide information, research, analyses and evidence on vocational education and training, skills and qualifications for policy-making in the EU Member States.

Cedefop was originally established in 1975 by Council Regulation (EEC) No 337/75. This decision was repealed in 2019 by Regulation (EU) 2019/128 establishing Cedefop as a Union Agency with a renewed mandate.

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Foreword

Alongside digitalisation and automation trends, the shift towards greener and more sustainable economies is a game changer in EU labour markets. Grounded in long-term transformative trends spanning several decades, the digital and green transitions are picking up speed. The resulting changes in skill needs will have impacts far beyond the key occupations driving them, affecting all economic sectors. An important challenge for the coming years is accelerating up- and reskilling so that people have the skills to thrive in more digital and greener jobs. The current EU vocational education and training (VET), employment and skills policy framework emphasises that – ultimately – skills drive and shape the transitions to more digital and greener societies. VET plays a crucial role in facilitating just transitions because its hands-on and work-oriented route to qualifications provides people with skills the labour market needs, and career development opportunities in the emerging post-pandemic jobs market.

When it comes to understanding, managing and shaping the digital and green transitions, reliable and trusted skills intelligence – information on labour market trends and skill needs – is indispensable. In the past decade, a lot of progress has been made in analysing the labour market and skills impacts of digitalisation and automation. The same cannot be said for greening. To respond to a growing need for 'green' skills intelligence, systematically exploring the jobs and skills implications of the green transition is a priority for Cedefop. This work directly contributes to realising the ambitions of the European Green Deal (EGD) and is – as the two are strongly interrelated – also relevant to the digital transition. It builds on earlier analysis on green jobs and skills, an area Cedefop has been active in for over a decade.

The work also contributes to our ambition of developing a new generation of skills intelligence that is in tune with trends in the world of work and in society more broadly. Cedefop's 'next-generation' skills intelligence is more transition-focused and user-centred and fully exploits the potential of combining sources to provide better and more actionable insights into what labour market trends mean for skills needs and learning.

This report takes a macro-perspective to understanding the employment and skills implications of implementing the European Green Deal. It uses

Cedefop's skills forecast framework to build a scenario that looks at the sectoral and occupational shifts at EU level that would likely occur if the EGD 2030 50-55% emission reduction target were fully met. The scenario provides a model-driven image of a greener future. Scenario findings are not to be used as precise, definite answers but can provide the background and context needed to shape future-oriented VET, employment and skills policies. We hope policy-makers and other stakeholders will benefit from the insights this report presents and use its findings to shape evidence-informed up- and reskilling policies driving the green transition.

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Executive summary

With the adoption of the European Green Deal (EGD) as its growth strategy, the EU bolstered its commitment towards a more sustainable economy and society. As underlined by global leaders at the COP26, the green transition means investing in bettering the lives of all citizens and workers, bringing about new jobs and better opportunities and life conditions. As with all investment policy decisions, understanding future trends and possible bottlenecks is crucial to facilitating the green transition. This is not only for making policy choices prudently, but also to be able to focus on success drivers and to build on existing green capacities in the economy and society.

Becoming 'greener' will bring about such profound changes in technology, design, production, services, consumption and investment that it is impossible to achieve without sufficiently skilled people. The skills forecast scenario presented in this report looks at the implications of the European Green Deal from a vocational education and training (VET) and skills perspective. Insights into the main green transition employment trends aim to inform policy-makers, social partners, education and training providers and individuals about where up- and re-skilling should focus to ease employment and career transitions.

A key scenario finding is that reaching the EGD goals is possible, with reasonable and attainable adjustment of relevant policies. The scenario also shows that the European Parliament's more ambitious goal of 60% reduction in greenhouse gas emissions by 2030 (compared to 1990) is also achievable with a reasonable uptake of renewables and technologies that lead to improved energy efficiency. Over the entire forecast decade, employment with the implementation of the EGD is higher than without it. The expected 1.2% additional employment growth up to 2030 associated with meeting the EGD targets, translates into approximately 2.5 million additional jobs in the EU. The fluctuation in additional employment growth at EU and sectoral level is likely a result of life cycles in implementing new technology. Expected additional employment growth is more pronounced in 2021-22, slows down in the middle of the decade and then accelerates from 2026 onwards.

Forecast sectoral employment trends

The profound effects of the green transition are evident from the EGD's forecast impact across sectors, at various intensities and directions. Unsurprisingly, there are 'winners' and 'losers', with sectors more directly linked to sustainability and climate change being more affected. This concerns water supply and waste management (triggered by the focus on circular economy), utilities (through increased recycling activities) and electricity supply (through increased demand for renewable energy). Other sectors that are quite strongly impacted include manufacturing of appliances/electrical equipment (as for the renewable electricity generation sector, or more-energy efficient appliances), construction, and the sectors that link to these via supply chains. The largest employment fall is forecast for coal mining and refined petroleum. EGD implementation is expected to increase employment in several service sectors, such as engineering and administration. In most other sectors, a possible redirection of employment towards cleaner production rather than an employment increase or decrease is forecast.

Characteristics of the current sectoral workforce, coupled with expected employment trends, can inform policy decisions relevant to gender participation and training uptake. Gender differences in employment in green sector 'champions' such as engineering and construction, as well as in mining occupations, indicate a need for more up- and re-skilling towards different career pathways or to accommodate new tasks in skills profiles for male workers.

Shifts and transitions

Implementing the EGD is expected to shift the sectoral composition of employment in the EU from polluting to 'cleaner' sectors and boost employment in some supporting services, albeit to a limited extent. When used in a national or regional economic context, the scenario findings make it possible to identify opportunities and challenges for labour market and training policies.

More disaggregated sectoral analysis fosters understanding of the intra-sectoral employment shifts set in motion by the green transition. In most

sectors, these are positive yet modest, while a few sectors are expected to experience more abrupt structural change. In sectors with mainly indirect implications from the EGD, such as legal, accounting and consulting activities, small positive employment effects are forecast. These can nevertheless signal important priorities for re- and upskilling. The renovation wave, for example leads to a need to train environmental lawyers and architects.

Manufacturing sectors will reflect the benefits of EGD implementation at different speeds. Clean steel technologies will ease the baseline scenario employment decline and will require targeted training to take up technological changes. The take-off of the circular economy is expected to change all processes across manufacturing sectors. In electronics this creates some additional employment growth by 2030 compared to the baseline scenario. In many other manufacturing sectors, employment changes are expected to be mild, with dynamics more likely to reflect intra-sectoral job-to-job mobility and up- or reskilling needs, rather employment flows between sectors.

About 286 000 energy sector workers (at all skill levels) may need to transition to a job in a greener sector. The commitment to phasing out fossil fuels, as also emphasised by world leaders during the COP26, requires both technological innovation and targeted VET provision to support those workers in making and shaping the energy transition.

Driven by sectoral and other trends, some occupations will face employment decline while others will see significant increases. Again, how employment evolves is strongly linked to the relevance of the occupation in sectors and its contribution to implementing the EGD goals. Most important, achieving the EGD does not only rely on high-skilled workers. The scenario results identify employment gains for almost all occupational categories, including middle-skilled ones and elementary occupations. The green transition has potential to alleviate progressive job polarisation.

VET policy decisions

The EGD scenario results demonstrate the importance of sectoral approaches in VET and skills policy and for integrated initiatives such as active labour market policies (ALMPs). Looking at the shifts within and across sectors and occupational categories uncovers significant up- and re-skilling potential; this needs to be translated into action to ensure workers gain the skills to

remain current in changing occupations or to transition from occupations and sectors in decline to greener jobs elsewhere.

Besides training to accommodate employment flows, the EGD scenario urges policy-makers to pay attention to high-skilled occupations involved in developing green technologies, such as scientists and researchers. Although relatively small in terms of employment share, these occupations are indispensable for achieving the green transition. The scenario also forecasts increasing employment in occupations that support such work or greening more generally, such as administration professionals, chief executives, senior officials and legislators, administrative and commercial managers, and information and communications technology professionals.

The findings also have relevance for other policy areas. The forecast employment increase for low-skilled occupations calls for measures to attract workers and policies to alleviate precarious employment. The significant increase in jobs for high-skilled workers in the computing sector clearly shows digital skills not only enable the digital transition, but also the green transformation. This hints at the importance of taking a holistic perspective to VET and skills, which incorporates all relevant megatrends. Silo-thinking is a barrier to making the complex socioeconomic transformation that is the green transition a success.

CHAPTER 1.

Introduction

1.1. Role of skills forecasts in preparing for change

Skills forecasts play a crucial role in facilitating and shaping change and transitions, as they provide evidence-based insight into labour market trends and a range of other societal developments and their implications. Their current use goes far beyond policy domains they traditionally targeted in the past, such as employment and education and training. Decision-makers in other policy domains (innovation, greening, migration and others) benefit from the future- and change-oriented perspective on the world of work that skills forecasts offer. Employers and sectors can use forecasts to anticipate future skills shortages and for developing training programmes and human resources policies to promote skills development and utilisation. Provided results are made accessible and presented in a user-friendly way, forecasts are an important support to individuals in making education, training and career choices.

Skills forecasts provide indications about future trends, not exact predictions. They are not to be used mechanistically, for example to determine the precise numbers of graduates needed from the education system to meet labour demand (Cedefop, 2021a). As they are rooted in past trends, forecasts tend to be more accurate in times when such trends can be expected to continue along stable trajectories. Shocks in the economy, caused by an economic crisis or unexpected events like the COVID-19 pandemic or significant changes in policies make it challenging to forecast what is likely to happen in the future.

This does not mean that skills forecasts are not useful in times of rapid change. Using them can be quite insightful for gaining deeper understanding of the impact of accelerating trends or shocks and isolating their impact by comparing alternative forecast outcomes with what would have happened in the 'business as usual' case. Comparative analysis of trends and the impact of shocks on labour markets, employment and skills, and the

interrelationships between them is a value-added of skills forecasts. Such insights support decision-makers tasked with policy-making in employment, education, skills development and related policy areas in making informed choices in a rapidly evolving context.

1.2. Cedefop skills forecasts and scenarios

Cedefop skills forecasts provide comprehensive and timely information about the current structure, and future trends, of the EU labour market ([1]). Typically incorporating data and assumptions spanning several decades, skills forecasts capture the long-term and stable structural megatrends that continuously shape and reshape the labour market. These include technological change, globalisation, the shift towards more service-based economies, demographic shifts such as population ageing, and the increasing education level of the population. Use of common methodology and harmonised information makes it possible to assess and compare employment trends in sectors, occupations and qualification levels in Member States and the Union as a whole (Cedefop, 2021b).

The skills forecasts are an important building block of labour market and skills intelligence (LMSI, also referred to as 'skills intelligence') and an invaluable tool for European policy-making. Alongside providing information that supports the monitoring and implementation of flagship EU policy initiatives such as the Skills Agenda ([2]), the EU VET policy framework ([3]) and the European Pillar for Social Rights ([4]), the forecast also plays an important role in assessing the future labour market impact of implementing EU priorities.

Skills forecast scenarios are particularly useful for reflecting on the employment impact of change that breaks with the past because it is caused by unexpected events, an acceleration of (technological or other) trends, important shifts in policies, or a combination of such shocks (see also

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([1]) For more details on Cedefop's skills forecast, the methodology, publications, data and information, visit the project page.

([2]) European Skills Agenda for sustainable competitiveness, social fairness and resilience (2020).

([3]) See the Osnabrück Declaration on vocational education and training for transition to digital and green economies (Osnabrück Declaration, 2020) and the Council Recommendation on VET for sustainable competitiveness, social fairness and resilience (Council of the European Union, 2020).

([4]) See the European Pillar of Social rights.

Cedefop, 2021a). Such scenarios incorporate assumptions about what could be their possible economic and labour market impacts, which are typically based on qualitative expert assessment. Skills forecast scenario building involves varying these and possibly other assumptions and subsequently re-estimating the forecast model to arrive at one or more alternative forecasts. Comparing these with the baseline – or 'business as usual' – forecast makes it possible to gain insight into the magnitude and direction of impact of the changes the scenario sets out to explore ([5]).

1.3. European Green Deal skills forecast scenario

Trends towards a greener and more sustainable economy have been considered in Cedefop's skills forecast framework and have been reported on for over a decade (see e.g. Cedefop, 2010). The European Green Deal (EGD) and its ambitious actions (Box 1) clearly signal a break with the green policies and frameworks of the recent past. Given its comprehensive nature and far-reaching ramifications, the EGD's potential impact on future employment is not fully reflected in the latest skills forecast, which was finalised in December 2019 before the EGD was announced.

The EGD relies on the implementation of a broad range of policies and targeted investments. The impact of the transition to a green economy will transcend the sectors more directly linked to sustainability and climate change. Not only sectors such as energy (especially renewables), transport, manufacturing (especially automotive, steel and iron), construction, agriculture, and waste management, but also others will be impacted, albeit at various intensities.

([5]) As part of the 2020 skills forecast, Cedefop has carried out several forecast scenarios to reflect on the impact of the COVID-19 pandemic and the automation of work, as well as a qualitative assessment of the possible employment effects of green policies similar to those of the EGD (e.g. Paris Agreement, energy efficiency of buildings, circular economy) as estimated by previous studies. See Cedefop (2021b).

Box 1. **European Green Deal**

- It is the European Union's answer to the growing problem of climate change and its repercussions and at the same time the bloc's growth strategy.
- It addresses the need to take immediate action to secure a better life for its citizens and for future generations.
- It sets the target to become the world's first climate-neutral continent by 2050.

The EGD priorities communicate the ambition to transform the Union into a modern, resource-efficient and competitive economy, where:
a) there are no net emissions of greenhouse gases by 2050;
b) economic growth is decoupled from resource use;
c) no person and no place are left behind.

Source: The European Green Deal.

Measuring the resulting employment effects of the green transition is challenging because it requires simultaneously evaluating all policies introduced and their direct and indirect economic and labour market impacts and interactions. The EGD skills forecast scenario presented in this report uses Cedefop's forecast framework to capture the likely employment effects in the EU-27 until 2030 of achieving the 50-55% emission reduction target, the overarching EGD ambition. The sectoral and occupational analysis aims to provide EU policy-makers with evidence-based insight and valuable feedback that will support the design and implementation of up- and reskilling policies to accompany the green transition.

CHAPTER 2.

Scenario approach and method

2.1. Introduction

Achieving the EGD goals will change sectoral employment levels and structure. As the new green paradigm calls for new approaches to production, design, development and use of materials, products and services, intra- and inter-sectoral changes in labour demand will be accompanied by changes in demand for occupations and skills. The occupational shifts implied by the green transition create significant demand for training and learning.

Equipping current and future workers with the necessary skills is a precondition for a just green transition. Yet, the scale of up- and reskilling needed in the EU for the green transition is uncertain, as several interrelated trends will create training and skilling needs:

(a) transition-oriented re-skilling will be needed for people whose skills will become obsolete as they are in declining sectors or occupations (e.g. coal mining and manufactured fuels);

(b) enough young people and adults will need to be trained to meet increasing demand for established 'green' occupations (including solar panel installers and technicians who install, maintain, relocate and decommission meteorological towers and equipment to measure the potential of wind energy);

(c) in occupations where the green transition does not fundamentally change tasks, upskilling will suffice (e.g. as the automotive sector transitions to producing electric vehicles);

(d) new and emerging occupations linked to new 'green' products, such as the (R&D) jobs/skills required to produce hydrogen-based energy ([6]) and to processes, such as carbon trading analysts, green marketers, and

([6]) See Bezdek (2019).

chief sustainability officers ([7]) and green ICT consultants ([8]) will require new programme and curriculum design.

Cedefop's EGD skills forecast scenario provides insight into impacts of the European Green Deal from a vocational education and training (VET) and skills perspective. It looks at the sectoral employment consequences of the most important policies the EGD encompasses. The resulting sectoral trends are used as a starting point for further analysis to inform evidence-based policy.

2.2. Scenario assumptions and caveats

The scenario assumptions incorporate information from various Commission communications on the sectors most targeted by the EGD and from carbon emissions reduction and sustainable economy policies (Box 2). These assumptions form the basis of the EGD scenario ([9]). To isolate the potential effects of the EGD and the resulting accelerating green transition from other megatrends, EGD scenario outcomes are compared with the pre-pandemic (baseline) Cedefop skills forecast ([10]).

([7]) See Occupational listings: green new and emerging occupations.
([8]) See ESCO (2020).
([9]) See Annex 2 for an overview detailing the main assumptions underlying the EGD scenario.
([10]) For more information see Cedefop (2021b) and the skills forecast project page.

Box 2. **European Green Deal skills forecast scenario: main assumptions**

- Scenario assumptions relate to the achievement of the 50-55% emission reduction target by 2030, sector- or technology-specific policies contributing to the emission reduction target, and circular economy plans.
- The assumptions incorporate increased energy efficiency (compared to baseline projections) and the cost needed to achieve it – linked to the Renovation wave, changes in the EU emissions trading system aimed at accelerating the renewable energy transition in road transport, and policies encouraging less carbon-intensive technology.
- The impacts of future price increases of polluting energy sources (through taxation) on road transport and buildings are also incorporated ([11]).
- Assumptions relating to the circular economy plan include increased recycling rates in sectors with high resource usage (e.g. electronics, plastics, vehicles) and harmonisation of the waste collection and management systems across the EU.
- The scenario analysis was carried out using the E3ME model assuming an ambitious implementation of the EGD, namely that the climate ambition targets set by 2050 are met. Following the European Parliament's more ambitious target, the 2030 emission reduction target was set at 60% ([12]).
- The scenario estimates aggregate (EU-27) sectoral employment from 2020 to 2030.

Source: Cedefop.

Designing and implementing fit-for-purpose up- and reskilling opportunities for workers also requires understanding of expected occupational developments. Occupational trend analysis gives insight into whether EGD implementation leads to an upsurge in highly skilled employment or fosters job polarisation. Such information can also inform vocational education and training (VET), employment and skills policy. The EGD scenario did not include assumptions on developments at occupational level. Therefore, in an attempt to gain some understanding of the underlying trends, the sectoral developments resulting from the EGD have been 'translated' to occupational trends (Box 3).

([11]) As the recent revision of the European Commission's Energy Tax Directive was agreed after the scenario was developed, it could not be reflected in its assumptions. See the relevant proposal (European Commission, 2021a).

([12]) See the relevant European Parliament press release (European Parliament, 2020).

As with any scenario, the range of factors considered, assumptions made, and the modelling choices do not reflect reality, but rather a model-driven approximation of it.

Box 3. **Methodology for identifying trends in occupations**

1. The EGD scenario (% differences in sectoral employment from the baseline) and the baseline skills forecast employment levels (000s) were used to calculate EGD sectoral employment levels (000s);
2. For each detailed NACE sector and for every year (2020-30), the employment shares of ISCO-2-digit occupations in the baseline scenario were obtained;
3. Occupation-by-sector employment in levels (000s) in the EGD scenario was obtained by multiplying sectoral employment (see 1) by the occupational shares (see 2);
4. Occupational employment levels (000s) were obtained by aggregating across sectors;
5. The change in occupational employment was obtained by comparing the baseline employment by occupation with employment by occupation in the EGD scenario (see 4).

Source: Cedefop.

The most important caveats applying to analysis based on the EGD skills forecast scenario cover several aspects.

(a) Currency: the scenario considers European Commission announcements, communications, amendments of previous directives and new ones until the time of modelling (late October 2020). Any later announcements or communications have not been considered.

(b) Completeness: while covering the essence and main policy aims of the EGD, the scenario does not cover all EGD policy areas. Policies not considered include Farm-to-fork strategy ([13]), better product design, empowering consumers, sustainable and smart mobility, and preserving and protecting biodiversity.

([13]) Agriculture could not be included in the EGD scenario. The EGD has a silent impact on employment levels but changes skills demand. The Farm-to-fork strategy promotes farming practices to remove CO2 from the atmosphere, which requires knowledge and skills on carbon-reducing practices, sustainable farming, waste management and waste-to-energy technology. See the relevant European Commission Communication (European Commission, 2020a)

(c) Level of analysis: the scenario considers employment levels and trends at the EU-27 aggregate level. It is obvious that the impact of the EGD will vary significantly across Member States and regions ([14]). In regions with a strong presence of sectors that are expected to be severely negatively affected (e.g. mining) the need for timely and targeted employment and skills transition policies will be higher than in regions with different sectoral employment structures.

(d) Scope: the scenario models the EGD impact on sectoral but not occupational employment. The impact on occupations has been calculated using the occupational shares within each sector obtained from the skills forecast baseline scenario for the years 2020 to 2030. This implies an assumption that the occupational distribution of employment in sectors will not shift as a result of implementing the EGD ([15]).

([14]) See the relevant opinion factsheet of the European Committee of the Regions: The impact of climate change on regions: an assessment of the European Green Deal and The Just Transition Mechanism.

([15]) This is a strong assumption, as preliminary studies suggest the green transition is likely to shift the occupational distribution in certain sectors (see the discussion section in Chapter 5 for more details). Nevertheless, in the absence of empirical estimates of such shifts, assuming the occupational distributions will not shift significantly appears to be a reasonable approach.

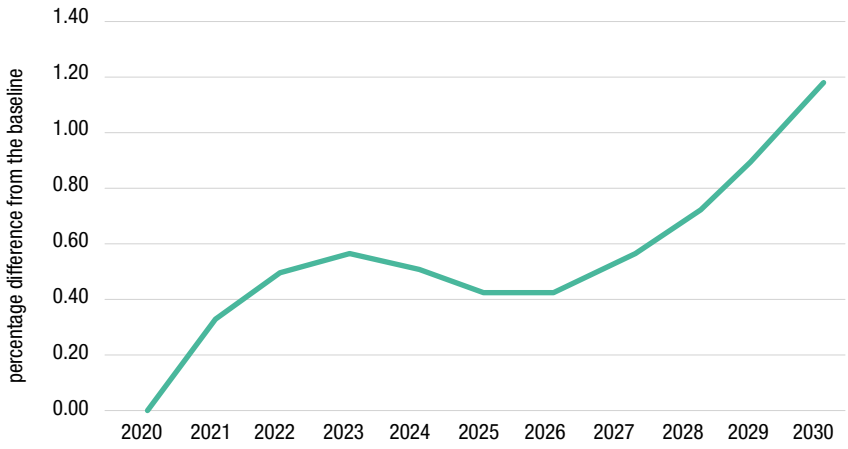
CHAPTER 3.

The EGD and employment

3.1. The employment impact of greening

The 2020 baseline (pre-COVID-19) skills forecast projected increasing employment in the European Union. Between 2020 and 2030, employment in the EU-27 was expected to increase by around 3.7%. The EGD scenario suggests the implementation of policies supporting it will increase GDP in the EU by around 1.7% (in 2030, compared to the baseline) and lead to additional employment growth ([16]). In the entire forecast period, employment with the implementation of the EGD is higher than without it (Figure 1).

Figure 1. **Forecast employment impact of the EGD (% difference between EGD skills forecast scenario and baseline), EU-27**



Source: Cedefop skills forecast, 2020 baseline and EGD scenario estimates.

Forecast employment growth in 2030 is approximately 1.2% higher than if the EGD emission target was not met. This amounts to around 2.5 million additional jobs in the EU. While greening the EU economy will certainly lead

([16]) This is in line with previous forecasts (see Eurofound, 2019; ILO, 2019).

to shrinking employment in several sectors heavily impacted by it, overall the EGD will result in net job creation.

An important conclusion of the EGD scenario is that it is economically feasible to meet the target of 60% reduction in greenhouse gas emissions by 2030 (compared to 1990 levels) with reasonable uptake of renewables and technologies that lead to improved energy efficiency. On top of the obvious economic and employment benefits, the emissions reduction (the scenario anticipates carbon dioxide (CO_2) emissions declining by almost 40% compared to the baseline) will improve EU citizens' wellbeing, because it contributes to better health and improved air quality and reduces environmental degradation.

Employment growth compared to the baseline appears to be larger in 2021-22, slows down in the middle of the decade and then accelerates from 2026 onwards. This is compatible with well-known theories on the life cycle of implementing new technologies. Employment will initially be boosted as a result of implementing green projects (including renovating buildings, constructing new recycling plants, shifting factory technology to clean energy-based). When other technologies reach the implementation stage some years later, their diffusion across sectors creates additional employment, for example in new recycling facilities or waste-water management systems. Over the forecast period, labour market participation is expected to grow, although gender differences are apparent (Box 4).

3.2. Sectoral employment trends

To achieve the zero-carbon target by 2050, the EGD focuses on energy-power generation and use, buildings, waste management and other parts of the manufacturing sector (such as recycling, plastics and electronics). This creates an expectation that employment changes linked to the EGD will be most pronounced in the sectors active in such activities.

In the EGD scenario, the sectors that are expected to see the largest employment gains are utilities (through increased recycling activities), electricity supply (through increased demand for renewable energy), manufacturing of appliances/electrical equipment (e.g. for the renewable electricity generation sector, or more-energy efficient appliances), construction, and the sectors that link to these via supply chains.

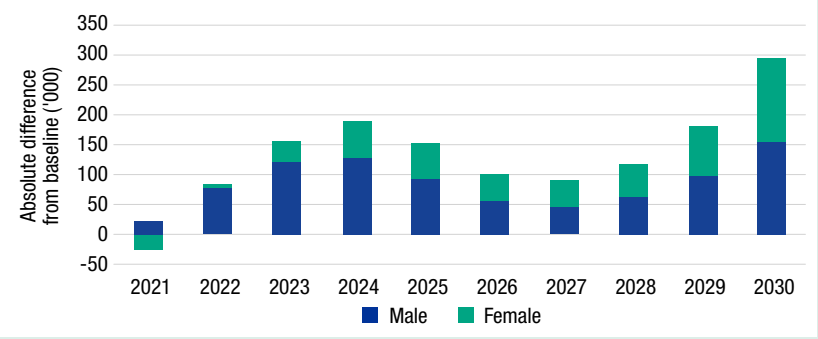
Besides the expected direct impact, the interconnectedness of economic activities through supply chains also creates expectations for the indirect

impact of the green transition on employment in other sectors. Changes in the profile of energy production will, for example, create jobs (and new occupations) in firms supplying new technologies. This effect is substantial. The EGD scenario forecasts employment growth to be 1% higher by 2030 compared to the baseline for service-based sectors, such as information and communication, real estate, professional, scientific and technical activities, and administrative and support service activities sectors.

Box 4. **EGD impact on male and female labour market participation**

- The European Green Deal appears to lead to increasing labour market participation. While both male and female participation is expected to grow, a larger increase in male participation is expected in 2021-26 (see Figure below). This is because, in this period, the expected fall in consumer activity impacts mainly service sectors, which have a higher female employment share.
- Sectors benefiting directly from the policies implemented to achieve the EGD target, such as engineering, construction, electricity supply and recycling, are more male dominated (see also EIGE, 2012). The same holds for sectors and occupations that are expected to be most negatively affected (e.g. mining).
- This suggests most up- and reskilling to accommodate new job creation and reallocation in other sector(s) will concern male workers (see also ILO, 2019).
- With activity in service sectors picking up by the end of the forecast horizon, the increase in female participation is expected to start nearing that of males.
- These trends underline the importance of attracting more female learners to 'traditionally' male-dominated education and training tracks, such as engineering. The resulting more equal female representation in the labour market and associated social benefits would contribute transversally to the EGD goals.

Figure: EU change in labour force, absolute difference from baseline, 000s



Source: Cedefop skills forecast, 2020 baseline and EGD scenario estimates.

3.2.1. **Trends in broad sectors**

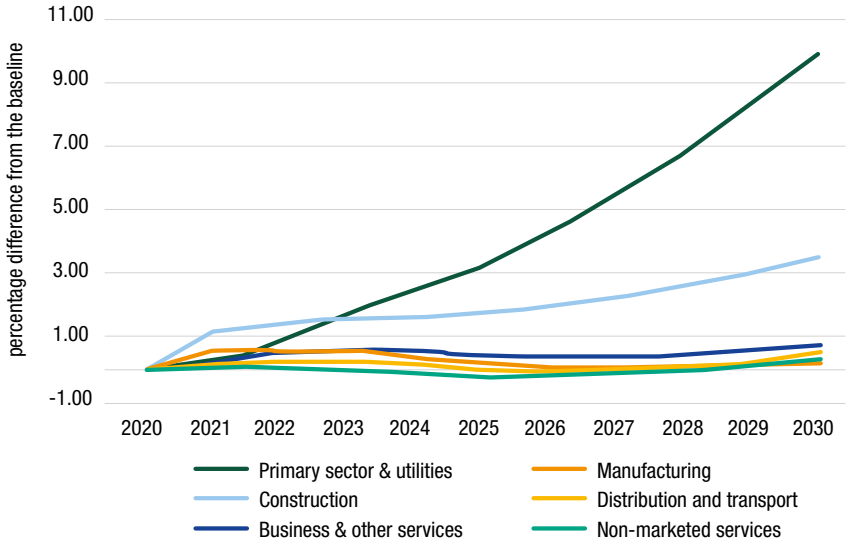
No broad sector appears to lose out in terms of employment as a result of implementing the EGD by 2030 (Figure 2). Some sectors, however, benefit much more than others. Employment in the primary sector and utilities and construction shows the most notable increases. Utilities ([17]) drive the employment increase in the broader sector it is part of. This can be attributed to increased recycling and increasing employment in electricity supply. Employment in provision of gas is expected to fall because the push towards increased energy efficiency will lead to lower production.

In the construction sector, which plays a pivotal role in achieving the green transition, employment is expected to increase initially by about 1.2% (possibly to cover staff needs when major new construction and renovation projects begin). The trend accelerates in 2027 and employment growth reaches a level in 2030 that is 3.6% higher than in the baseline. This trend may be attributed to the wider diffusion of EGD policies (in particular the renovation wave) affecting the sector ([18]).

Constructing energy-efficient buildings will require workers to be more aware of eco-friendly materials and technologies. An estimated 3 to 4 million construction workers in various occupations such as heat pump boiler installers, carpenters and joiners, bricklayers, and technicians will require training on energy efficiency and renewable energy sources. Construction workers are often found to lack knowledge on how to reuse and recycle industrial/construction waste (ECSO, 2020).

([17]) Including: electricity, gas, steam and air conditioning, and water supply.
([18]) See European Commission (2020b).

Figure 2. **Forecast employment impact of the EGD (% difference between EGD skills forecast scenario and baseline) by broad sector, EU-27**

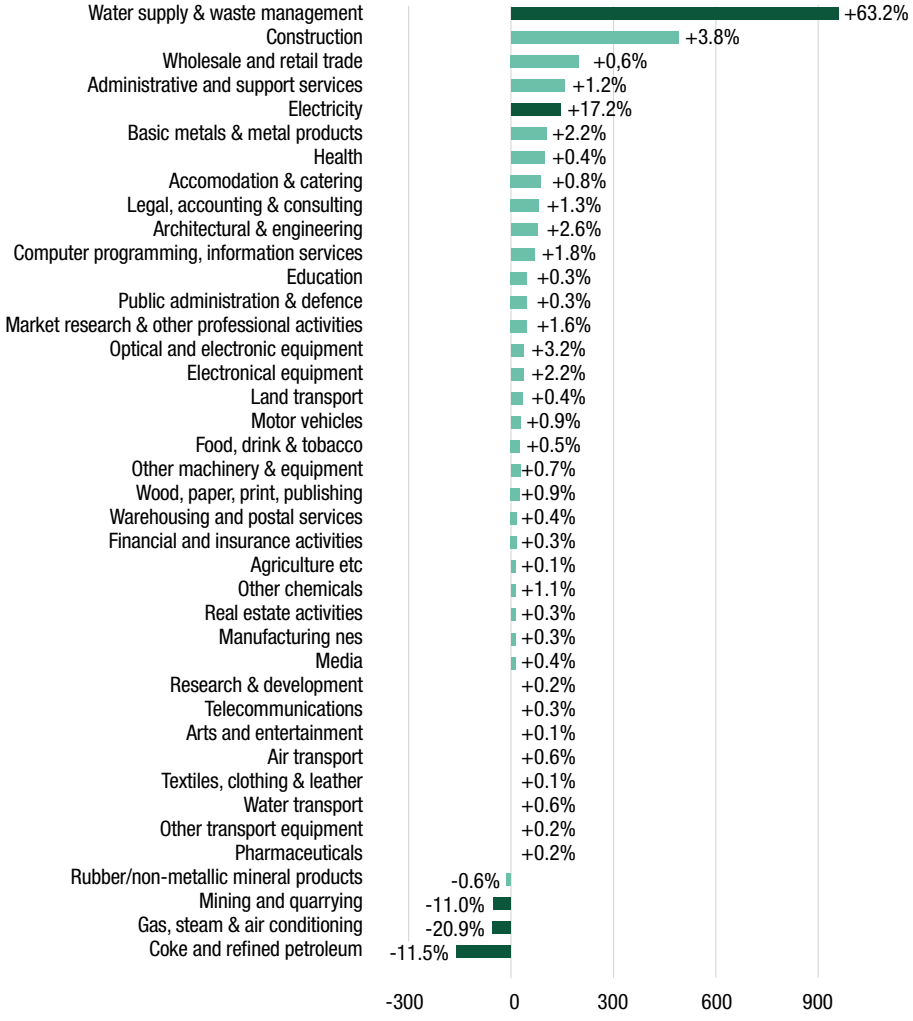


Source: Cedefop skills forecast, 2020 baseline and EGD scenario estimates.

3.2.2. Sectoral employment trends in detail

To understand the intra-sectoral employment shifts set in motion by the green transition, the scenario information must be viewed at more disaggregated level. The brunt of the employment impact of the EGD is concentrated in a few sectors. In most others the shifts are modest, albeit positive (Figure 3).

Figure 3. **Forecast employment impact of the EGD (difference between EGD skills forecast scenario and baseline in 000s and %) by detailed sector, EU-27**



NB: The percentages indicate the difference in forecast employment growth or decline (in %) between EGD and baseline scenario. Dark shaded bars indicate substantial differences (+/- 10% or more).

Source: Cedefop skills forecast, 2020 baseline and EGD scenario estimates.

The scenario gives valuable insight into the employment implications of the energy transition. Mining and quarrying, coke and refined petroleum, and gas, steam and air-conditioning are most negatively impacted by EGD implementation. The forecast employment decline in these three sectors is 286 000 jobs (on top of the baseline forecast). With 27% fewer workers by 2030 (compared to 16% in baseline scenario projections), phasing out coal is set to accelerate the employment decline in mining and quarrying. Compared to the baseline, the employment fall set in motion by the shift towards renewables is more than four times higher in the coke and refined petroleum sector and almost double in the gas, steam and air-conditioning sector. Employment in the electricity sector is forecast to increase by 197 000 jobs by the end of the decade, almost four times what was forecast in the baseline scenario.

Water supply and waste management appear to benefit most from the EGD. While employment in this sector trends slightly downward in the baseline forecast, the EGD scenario forecasts an employment increase of over 60% between 2020 and 2030. Beyond avoiding the job losses forecast in the baseline, implementing the EGD is expected to create around 941 000 additional jobs. This can be attributed to increasing employment in the design of waste management and sustainable water (re)use facilities and their operation. The main aims set out in the Circular economy action plan (European Commission, 2020c) – harmonising the separate waste collection systems across the EU, minimising the presence of harmful substances in waste water, and re-use and recycle policies affecting the sector – drive these trends (European Commission (2020c).

The EGD impact on employment in other sectors is predominantly indirect. Employment in administrative activities is forecast to grow by 8.4% until the end of this decade, 1.2% more than in the baseline projections. This likely reflects the fact that national level implementation of green policies requires appropriate institutional capacity and preparedness. This ranges from planning, development of 'green' standards, to monitoring policy implementation and even green procurement (European Commission, 2016). Employment growth in legal, accounting and consulting activities in 2020-30 is forecast to be 1.3% higher (8.7% against 7.4% in the baseline), while in architecture and engineering it is 2.7% higher (7.7% versus 5%). This reflects increased demand for professionals supporting the implementation of EGD policies, such as architects for the renovation wave, engineers for designing circular economy processes and environmental lawyers. The

forecast employment increase in computer programming (+1.8%) likely reflects automation/robotics trends and shows the digital transition fuels the green transition.

3.2.3. **Trends in manufacturing sectors**

The investment needed to achieve decarbonisation, foster recycling and introduce clean steel breakthrough technologies in the steel and related metals sector will ease significantly the baseline scenario employment decline in the basic metals sector, implying that about 100 000 jobs will likely not be lost by 2030. Also, intensifying reuse and recycle practices in the production of electronics and electrical equipment such as batteries are expected to create additional employment growth by 2030 (+3.2% and +2.2% respectively compared to the baseline forecast).

The motor vehicles sector is only expected to gain an additional 1% in employment (around 23 000 jobs) in the EGD scenario compared to the baseline. This is likely the result of the sector being a forerunner in investing in robotics, automation and artificial intelligence, paving the way for the green transition long before the EGD was ratified. By 2020 many vehicle manufacturers had already made necessary changes in production and hired new workers or trained their staff to shift towards making electric engines and electronic vehicles. As the sector is relatively well-prepared for the changes the EGD promotes, and appears well placed to use the opportunities automation offers, there is no immediate need to increase employment ([19]). Once electronic vehicles become the norm in the more distant future, employment could decrease while increasing use of AI technology could shift professional profiles and increase digital skills needs ([20]).

In most other manufacturing sectors EGD policies do not appear significantly to affect future employment trends (see Figure 3). This is an important and policy-relevant scenario finding, as it suggests many shifts in employment and skills linked to the green transition are expected within

([19]) The impact of the switch from internal combustion to electric vehicles will most likely vary depending on the degree of automation, the pace of change within the sector and the competitive position of the EU automotive sector globally (CISL, 2020; ETUI, 2019; European Commission, 2017b).

([20]) As electric cars are mechanically simpler than traditional ones, with estimates showing 30% fewer hours are needed to manufacture them, the automotive industry might face considerable job losses in the future. The demand for digital skills and high-skilled workers may follow the 'east-west' divide in the 2010-20 employment growth pattern in the sector. See Renew Europe (2020) and Cedefop (2021c).

manufacturing sectors via intra-sectoral job-to-job mobility and up- or reskilling, rather than to or from them.

To make and shape the green transition, workers in manufacturing will need 'green'-ignited up- or re-skilling. Like construction firms, manufacturing companies must significantly reduce their carbon footprint, pollution and waste and increase recycling. They will be motivated, incentivised or obliged to introduce environmentally friendly production techniques and to start thinking about their products in a circular way so that they become more reusable, durable and repairable. This will create the need to train professionals involved in product design (such as appliances, machines or vehicles) and workers involved in product repair. From a longer-term perspective, widespread staff training may be a precondition for employment growth in manufacturing to materialise. In case many companies choose to 'buy' the skills and expertise they need to bring green and innovative technologies to their plants and outsource technology design and installation, any employment gains will likely occur elsewhere ([21]).

Implementing the EGD is expected to shift the sectoral composition of employment in the EU from polluting to 'cleaner' sectors and boost employment in some supporting services, albeit to a limited extent. When used in a national or regional economic context, the scenario findings make it possible to identify opportunities and challenges for labour market and training policies (see also Chapter 5).

([21]) See Cameron et al. (2021) on the decarbonisation road map for the food and drink manufacturing sector or BOF and McKinsey Company (2020) on the situation in the fashion industry.

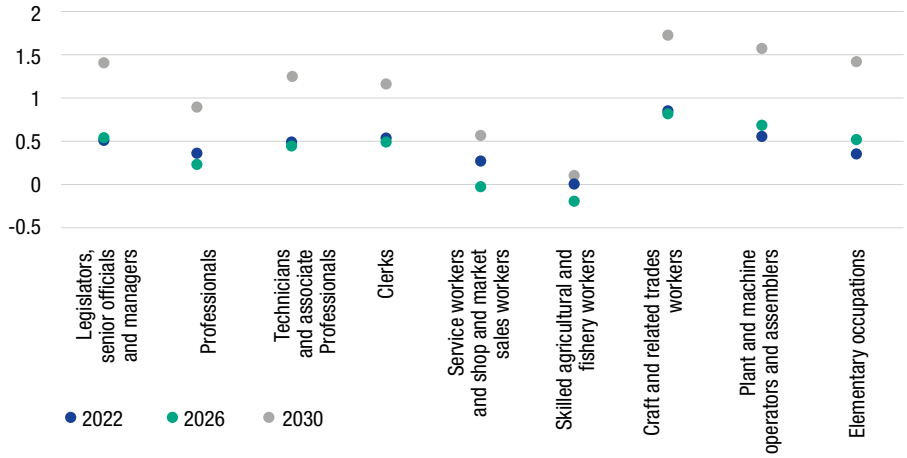
CHAPTER 4.

Trends in occupations

4.1. Broad trends

Employment appears to benefit (at least slightly) from the transition towards a carbon-neutral economy in most broad occupational categories (Figure 4) ([22]). The employment gains are slightly more pronounced for some of the medium- and low-skilled occupations. The forecast additional employment growth by 2030 is highest for crafts and related trade workers (+1.7%) and plant and machine operators and assemblers (+1.6%) and in elementary occupations (+1.4%). Among high-skilled occupations, employment is set to increase most for legislators, senior officials and managers (+1.4%). Technicians and associate professionals (+1.3%) and clerks (+1.2%) follow closely.

Figure 4. **Forecast employment impact of the EGD (difference between EGD skills forecast scenario and baseline in %) by broad (ISCO 1 digit) occupation, EU-27**



Source: Cedefop skills forecast, 2020 baseline and EGD scenario estimates.

([22]) For information on the method used to derive occupational trends, see Chapter 2.

There will be clear 'winners' and 'losers' from the EGD. Some occupations (e.g. in coal mining) will face employment decline while others (e.g. emerging occupations in hydrogen production) will see growth (European Commission, DG ENER, 2021). Notwithstanding, the employment benefits of the EGD appear to be diffused across almost all occupational categories. From a policy perspective, this is an interesting finding. It shows that greening the EU economy will not rely solely on high-skilled workers and that implementing the EGD tends to ease rather than exacerbate job polarisation (Cedefop, 2011; Cedefop, 2012).

Digging deeper into employment changes in the decade 2020-30, forecasts by the baseline and EGD scenarios, and their differences, provide more insight into the employment dynamics of the green transition (Table 1). Implementing the EGD leads to an additional 1.5% employment increase for plant and machine operators and assemblers by 2030 (around 250 000 extra jobs) and about 330 000 additional elementary jobs. These are likely to cover additional employment needs in new recycling factories, construction of electric vehicle charging stations and waste management facilities. Implementing the EGD will lead to declining employment for craft and related trades workers of around 290 000 jobs by 2030, much less than the over 700 000 jobs lost according to baseline projections. This means one of the impacts of the EGD is 400 000 medium-level jobs not being lost because of increased labour market needs spearheaded by EGD policies. These additional jobs may concern assembling new technology (such as electric vehicle engines) or its implementation (building renovation and installing clean energy-based heating systems).

Table 1. **Forecast employment change by broad (ISCO 1 digit) occupation between 2020-30 in the baseline and the EGD skills forecast scenario**

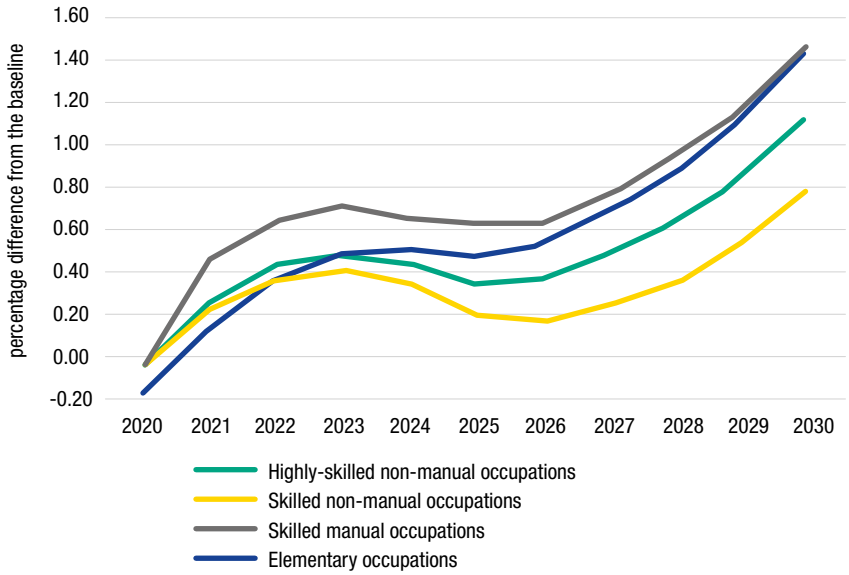
Scenario				
	Baseline		EGD scenario	
Broad (ISCO 1 digit) occupation	**Employment change (in %)**	**Employment change (in 000s)**	**Employment change (in %)**	**Employment change (in 000s)**
Legislators, senior officials and managers	9.9	1064	11.5	1240
Professionals	10.8	4094	11.8	4492
Technicians and associate professionals	9.5	3289	10.9	3770
Clerks	-2.2	-428	-1.1	-204
Service workers and shop and market sales workers	3.8	1311	4.4	1527
Skilled agricultural and fishery workers	-21.5	-1664	-21.3	-1642
Craft and related trades workers	-2.9	-704	-1.2	-290
Plant and machine operators and assemblers	0.4	68	2.0	322
Elementary occupations	3.0	590	4.6	917

Source: Cedefop skills forecast, 2020 baseline and EGD scenario estimates.

The attenuating effect of the EGD on polarisation is also visible from employment trends by skills level (Figure 5). The differences between EGD scenario and baseline projections for employment by skills level between 2020 and 2030 follow a pattern similar to that observed for total employment (Figure 1). Forecast employment increases fast initially and accelerates around 2026, when many green investments reach the operational stage and require additional personnel. The positive employment effects of the EGD are diffused at all skill levels. Although higher-skilled workers' creativity and innovation are essential for climate technology breakthroughs, employment

in skilled manual and elementary occupations are expected to grow faster than high-skilled occupations. This suggests that the EGD may alleviate progressive job polarisation in European job markets.

Figure 5. **Forecast employment impact of the EGD (% difference between EGD skills forecast scenario and baseline) by skills level, EU-27**

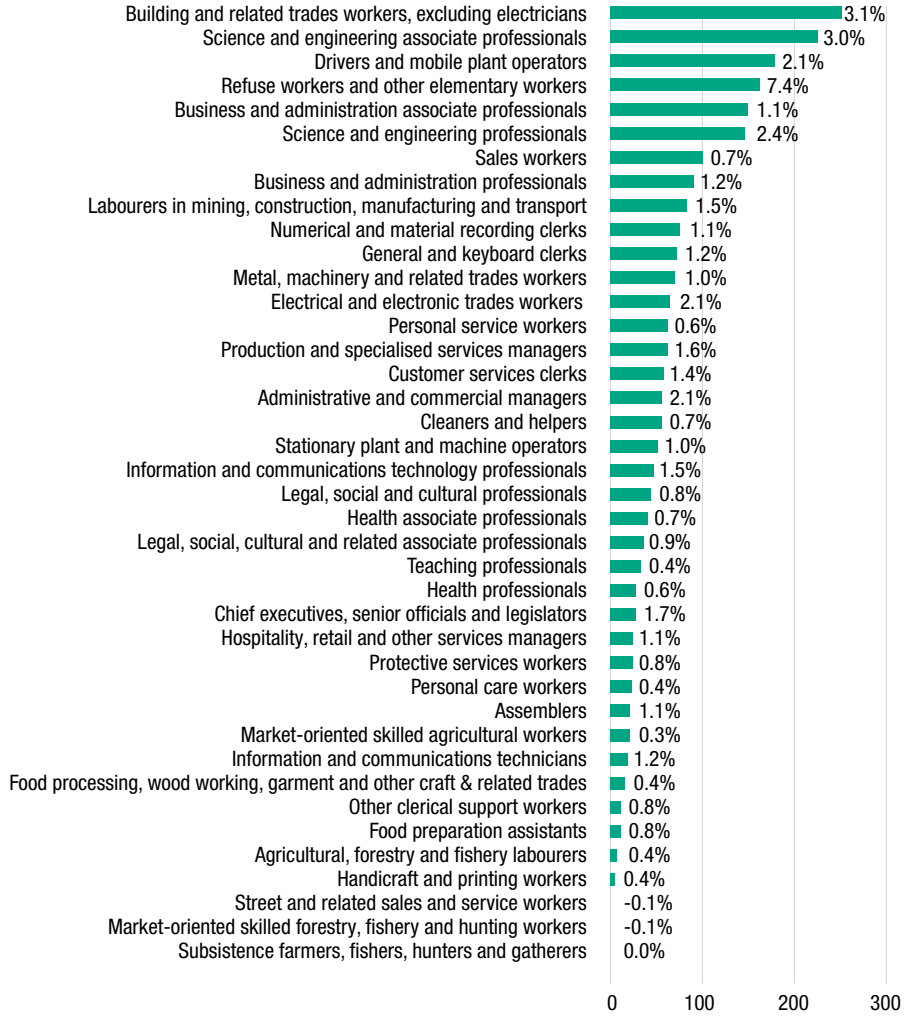


Source: Cedefop skills forecast, 2020 baseline and EGD scenario estimates.

4.2. Occupational employment trends in detail

Broad trends more detailed analysis of occupational level changes points towards the importance of highly skilled non-manual occupations in driving (as with scientists) and supporting (public officials and managers) EGD implementation (Figure 6). The EGD scenario forecasts significant additional employment increases (compared to the baseline) for science and engineering (associate) professionals, business and administration professionals, chief executives, senior officials and legislators, administrative and commercial managers, and information and communications technology professionals.

Figure 6. **Forecast employment impact of the EGD (difference between EGD skills forecast scenario and baseline in 000s and %) by detailed occupation, EU-27**



NB: The percentages indicate the difference in forecast employment growth or decline (in %) between EGD and baseline scenario.

Source: Cedefop skills forecast, 2020 baseline and EGD scenario estimates.

Comparing forecast change in employment levels in the baseline with the change emerging from the EGD scenario shows that EGD-driven employment trends are likely to benefit a broad range of medium-skill occupations. In relative terms, the highest impact is expected for refuse workers, building and related trades workers, electrical and electronic trades workers and drivers. A clear positive EGD employment impact is also expected for customer service clerks and assemblers. Employment trends in health and food processing and preparation occupations appear to be relatively unaffected by the green transition ([23]).

Analysing forecast developments of occupational employment within sectors helps shed more light on the complexity of the green transition in terms of its socioeconomic impact. Comparing positive and negative EGD scenario sectoral employment trends (Table 2) suggests transitions will need to take place across several sectors ([24]). As a result of phasing out fossil fuels, up to 286 000 energy sector workers (at all skill levels) may need to transition to a job in a sector where EGD implementation has a positive impact on labour demand. Such transitions are not straightforward: they will require reskilling to familiarise workers with – possibly – new green technology and to help them acquire the knowledge they need to start working in a different sector. At the same time, employment in sectors such as water supply will expand across occupational levels.

Trends within and across sectors will shape VET provision, for IVET and up- and re-skilling. Notable in this context is also the forecast demand for highly skilled workers in the computer programming sector, where more than 86% of the forecast employment boost will be jobs for high-skilled workers. This can be interpreted as evidence of the intricate links between the digital and the green transition. The policy implication is that it is neither possible nor desirable to analyse megatrends and their employment and skills implications in isolation. Skills necessary to design, apply and implement technologies that are focused on or indirectly facilitate 'greening' should be viewed as symbiotic to 'green' ones, more directly linked to the green transition. VET-wise,

([23]) As the EGD scenario does not consider policies relevant to the *Farm-to-fork strategy*, results for agriculture and related occupations should be treated with caution. The same holds for employment trends in health occupations, which is strongly affected by other socioeconomic megatrends (e.g. changes in demographic composition of the workforce).

([24]) This finding is corroborated by other analyses, too. See, for example, European Commission (2021b).

this calls for a holistic approach to adapting programmes, curricula and teaching and learning.

Table 2. **Forecast job creation and destruction in 2020-30 linked to EGD implementation in most heavily impacted sectors by occupation level (difference in employment levels between baseline and EGD skills forecast scenario)**

Occupation	Coke & refined petroleum products	Gas, steam & air conditioning	Mining and Quarrying	Water supply, Sewerage, Waste management & Remediation activities	Construction	Electricity	Computer programming, information services
Highly skilled non-manual occupations	-62.7	-36.0	-19.4	404.1	122.5	90.9	56.3
Skilled non-manual occupations	-14.5	-8.4	-3.9	104.3	28.6	20.3	4.8
Skilled manual occupations	-76.8	-14.5	-31.4	244.9	305.2	28.5	3.7
Elementary occupations	-13.7	-1.3	-3.4	207.3	30.4	2.8	0.5
Total	**-167.8**	**-60.3**	**-58.2**	**960.5**	**486.6**	**142.4**	**65.3**

NB: A main assumption underlying the analysis is that the occupational composition of employment in sectors is not affected by EGD implementation (see also Chapter 2).

Source: Cedefop skills forecast, 2020 baseline and EGD scenario estimates.

CHAPTER 5.

Reflection and lessons for policy

5.1. Key scenario messages

With the European Green Deal, the EU has bolstered its commitment to becoming a global champion in greening its economy and society. The COVID-19 pandemic and the significant business disruption that followed ([25]) did not stall EGD implementation but was perceived as an opportunity to couple economic recovery with an environmentally sustainable future. Cedefop's EGD scenario results help in assessing its likely employment effect in the EU by 2030 and can be used to enlighten policy-makers, social partners and individuals about where up- and re-skilling could focus to ease and accelerate the green transition.

Although the main employment effects appear to be concentrated in sectors directly targeted by EGD policies (e.g. extraction industries, construction and waste management) the EGD is also expected to increase employment in several service sectors, such as engineering and administration. In most other sectors, a possible redirection of employment towards cleaner production rather than an employment increase or decrease is forecast. This corroborates other research, which finds that the green transition drives skills and training needs in all sectors.

The green transition is an economic and societal transformation rather than a linear change process. Reliably mapping its terms of employment and skills impacts is enormously complex, not least because its evolution crucially depends on public investment effectiveness and policy stability and coherence. Caution is therefore advised when using and interpreting scenario results. The main contribution of the EGD scenario is a model-driven image of the future; policy-makers and other stakeholders should view the findings as such and resist the temptation to view forecast employment levels and trends as (near) certainties. The scenario results may be viewed as rather optimistic as they show the green transition will have a positive bottom line

([25]) See also Van Loo et al. (2021).

employment impact. In addition, as usual in a *ceteris paribus* scenario, other possible influences are not considered. For instance, if other trends (notably automation) accelerate in the years up to 2030, employment growth may not (fully) materialise. Notwithstanding this, the scenario has significant policy relevance.

5.2. Easing the green transition via up- and reskilling

The findings in this report underline the importance of a sectoral focus in education, training and skills policies. They call for a comprehensive approach to developing training policies to tackle challenges and opportunities at both ends: sectors (and respective occupations) expected to drive greening and those facing gradual decline and possibly phase-out as a result of it.

To understand how to go about setting broad priorities for up- and reskilling, it is insightful to look at sectors strongly affected by the trend towards greener and more sustainable economies. In mining, for example, the energy transition calls for mobility-oriented up- and re-skilling, so that workers can make the transition to greener sectors or occupations. Workers extracting coal can acquire new skills to find employment in renewable energy technologies ([26]). As such jobs require employees with advanced STEM skills, policy coordination is important. This helps ensure the new or adjusted education and training programmes and curricula meet skills requirements and workers' needs. Some types of mining, such as lithium extraction, which is crucial to produce batteries powering electric vehicles, will continue. For this part of the sector, the approach to training and up- and reskilling workers should aim at building on existing skills insofar possible, reconciling EGD policy ambitions with increased demand for raw materials, and greening operational processes.

The strong sectoral component in the EGD's impact not only calls for targeted training activities at that level but also underlines the need for better sectoral skills anticipation. Although data and qualitative analysis at EU or Member State level can shed light on megatrends, understanding how these will work out in practice is difficult without analysis at sectoral (and in some

([26]) Alves Dias et al.(2018) show that jobs in wind and solar photovoltaic (PV) energy are the most suitable workplaces for former coal workers.

cases sub-sectoral) level. Complementing such work with occupational analysis has significant potential for evidence-based policy-making. Gaining solid insight into greening trends means going beyond mapping shifts between sectors and occupations. Grasping what is happening within them – in different occupations in the same sector or in a single occupation across sectors – is key to shaping up- and reskilling policies and practices. The unique combination of trends and their implications provides an image of the context within which up- and re-skilling should take place and helps in setting its aims and objectives.

5.3. Lessons for policy

The European Green Deal has a strong social component. It aims to ensure just transitions for workers and to smooth the economic and social impact for countries, regions and communities. As shown in our analysis of the EGD's employment implications, this is important not only for equality reasons but also to make the green transition possible. Apart from targeted investment to alleviate shocks and develop skills, a comprehensive approach to skills matching should also be a policy priority. High-quality skills intelligence can help identify 'skills ladders' facilitating workers' mobility to other sectors or alternative occupations within their sector. Career guidance plays a crucial role in making such transitions happen. Widely available and accessible career guidance with an awareness-raising component could also help attract people to promising 'green' jobs and sectors. This can contribute to overcoming negative stereotypes (e.g. about construction or waste management jobs) and gender imbalances in traditionally male-dominated occupations (such as engineering). Boosting awareness of, and access to, green and STEM skills has a double dividend: strengthening the social and economic position of vulnerable groups and stepping up their contribution to achieving the EGD targets. In this context, VET is a central enabler of economic and social change.

The anticipated increase in skilled-manual and elementary occupations can have implications for other policy areas: examples include migration policy and employment and social policies aimed at addressing the precariousness of employment (e.g. sorters in recycling factories). Given the central role of technology in greening the economy, the forecast employment

boost for scientists and engineers ([27]) is less surprising. Particularly in sectors such as energy, they will drive 'green-tech' breakthroughs and shape newly emerging high-skilled occupations (e.g. hydrogen engineers). Some of these R&D occupations represent a relatively small, but nonetheless indispensable share of employment because greening is not possible without their contribution to developing technologies and making them economically viable. Investing in engineering and scientific skills to ensure their availability should be a top policy priority.

The geographic variation in the impact of the EGD is crucially important for policy design and uptake at national and regional levels. Focusing on the green transition in the EU, Cedefop's EGD scenario did not examine the impact of geographic specificities on employment trends. Naturally, training and skilling policies and measures need to fit reality at Member State or regional level. Regions with sizable employment in coal mining ([28]) or traditional (internal combustion engine power) vehicle manufacturing will be disproportionately impacted. The resulting labour market imbalances can be addressed by movements of people within and between countries, but this will not happen without sound skills intelligence and adequate support ([29]). In preparing for the green transition, active labour market policies and social protection measures need to be designed and implemented in ways that alleviate negative impacts, particularly for the most vulnerable regions and their populations.

Many education and skill policies currently in force might require adaptation or reform to accommodate up- and reskilling needs and mobility. Given that the twin (green and digital) transitions are mutually reinforcing transformations, many green jobs will require better digital skills compared to jobs in 'brown' sectors, irrespective of skill level. The potential role of digital skills as a green transition enabler is apparent, for example, from current physical production lines, which rely on digital software and tools and remote digital human interaction. AI technology is increasingly deployed to increase resource efficiency and monitor production processes. The more

([27]) See Vona et al. (2015).

([28]) One Polish region may lose up to 41 000 jobs by 2030, and a further three (in Bulgaria, Czechia and Romania) are likely to lose an estimated 10 000 jobs each. See Alves Dias et al. (2018).

([29]) At EU level, the talent partnerships launched in the context of the New pact on migration and asylum aims to address skills shortages in the European Union and to strengthen mutually beneficial partnerships on migration with third countries. See the European Commission Talent partnerships web page.

harmonised waste collection and management systems that will emerge soon will most certainly be digitally monitored, not only centrally, but also 'on the spot' by maintenance workers using a portable digital device to detect and report issues. Similar trends in other sectors make improving digital skills even in low-skilled jobs a necessity ([30]).

5.4. Final word

The forecast scenario presented in this report shows that the implementation of EGD has the potential to generate positive labour market impacts. These will not materialise without stable policy commitment and active stakeholder involvement and cooperation. Governments, employers, regional and local authorities, VET and other types of providers, research institutions and other actors are jointly responsible for managing skills ecosystems and need to share design and policy implementation to make the green transition smooth and inclusive and to keep it on track. Encouraging and facilitating up- and reskilling across the board to help people keep up with change should be seen as the core of a viable green and just transition. Providing guidance and support to groups of workers who – in order to stay economically active – will need to change occupation, sector or geographic location or acquire completely new skill sets is a further, and likely even more challenging, task.

In this context, cooperation, joint ambition and the drive to achieve the European Green Deal targets are one essential part of the equation. Another part is reliable and timely information and insight into structural trends and their impact on sectors, occupations and skills: this is skills intelligence. At EU level, Cedefop is expanding skills intelligence work focused on the green transition. Skills foresight outcomes in sectors that are vital to managing the green transition and new work that exploits information on green jobs and skills in online job advertisements (Cedefop-Eurostat OVATE project) will provide policy-relevant information complementing and enriching the findings presented in this report.

([30]) See discussions about skills requirements for steel sector in EASME (2020).

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Web pages

Cedefop skills forecast
https://www.cedefop.europa.eu/en/tools/skills-forecast
European Commission – A European Green Deal
https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
European Commission Talent Partnerships
https://ec.europa.eu/home-affairs/policies/migration-and-asylum/legal-migration-and-integration/talent-partnerships_en
European Pillar of Social Rights
https://ec.europa.eu/info/strategy/priorities-2019-2024/economy-works-people/jobs-growth-and-investment/european-pillar-social-rights_en
European Skills Agenda for sustainable competitiveness, social fairness and resilience https://ec.europa.eu/social/main.jsp?catId=1223&langId=en
The Just Transition Mechanism
https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en

ANNEX 1.

Forecast detailed trends in sectors and occupations

Table A.1 **Forecast employment change (% and absolute change between 2020 and 2030) by detailed sector, EGD skills forecast scenario vs baseline, EU-27**

Scenario				
	Baseline		EGD scenario	
Sector (NACE 2 digit)	Employment change (in %)	Employment change (in 000s)	Employment change (in %)	Employment change (in 000s)
Agriculture, etc.	-26.6	-2487	-26.5	-2473
Mining and quarrying	-15.5	-82	-26.5	-141
Food, Drink & Tobacco	-3.9	-175	-3.4	-153
Textiles, Clothing & Leather	-21.6	-455	-21.5	-454
Wood, paper, print, publishing	-1.9	-43	-1.1	-24
Coke & refined petroleum products	-3.1	-46	-14.7	-213
Other chemicals	-7.3	-79	-6.2	-67
Pharmaceuticals	0.5	2	0.7	3
Rubber/non-metallic mineral products	-1.9	-53	-2.5	-70
Basic metals & metal products	-5.0	-222	-2.8	-125
Optical & electronic equipment	7.1	77	10.3	111
Electrical equipment	4.1	61	6.3	93
Other machinery & equipment	0.6	17	1.3	37
Motor Vehicles	3.9	100	4.9	124
Other Transport Equipment	0.2	1	0.4	2

Scenario				
	Baseline		EGD scenario	
Sector (NACE 2 digit)	Employment change (in %)	Employment change (in 000s)	Employment change (in %)	Employment change (in 000s)
Manufacturing nes	-2.1	-43	-1.9	-37
Electricity	6.6	55	23.7	197
Gas, steam & air conditioning	7.1	21	-13.8	-40
Water supply	-1.3	-20	61.9	941
Construction	5.2	671	9.0	1157
Wholesale and retail trade	5.6	1706	6.2	1899
Land transport	8.0	470	8.4	495
Water Transport	-7.4	-18	-6.9	-16
Air Transport	-0.7	-2	-0.1	0
Warehousing and postal services	2.5	99	2.9	116
Accommodation & Catering	11.2	1149	12.0	1229
Media	-4.7	-61	-4.3	-56
Telecommunications	3.6	31	4.0	33
Computer programming, info serv	15.1	536	17.0	602
Financial & insurance activ	1.2	61	1.5	76
Real estate activities	12.4	269	12.7	277
Legal, account & consulting	7.4	453	8.7	531
Architectural & engineering	5.0	142	7.7	216
Research & Development	15.6	187	15.8	189
Market research & other prof	9.1	228	10.8	269
Admin. and support services	7.2	939	8.4	1092
Public administration & defence	4.0	543	4.3	585

Scenario				
	Baseline		EGD scenario	
Sector (NACE 2 digit)	**Employment change (in %)**	**Employment change (in 000s)**	**Employment change (in %)**	**Employment change (in 000s)**
Education	6.5	868	6.8	911
Health	10.1	2163	10.5	2257
Arts and entertainment	4.9	93	5.0	95
Other service activities	3.6	394	3.6	394
Total employment	3.7	7547	4.9	10063

Source: Cedefop skills forecast, 2020 baseline and EGD scenario estimates.

Table A.2 **Forecast employment change (% and absolute change between 2020 and 2030) by detailed occupation, EGD skills forecast scenario vs baseline, EU-27**

Scenario				
	Baseline		EGD scenario	
Occupation (ISCO 2 digit)	Employment change (in %)	Employment change (in 000s)	Employment change (in %)	Employment change (in 000s)
Chief executives, senior officials and legislators	9.2	152	10.9	180
Administrative and commercial managers	18	507	20.1	565
Production and specialised services managers	6.1	233	7.7	296
Hospitality, retail and other services managers	6.9	172	8	198
Science and engineering professionals	14.8	922	17.2	1070
Health professionals	9.8	528	10.3	557
Teaching professionals	2.9	281	3.3	316
Business and administration professionals	14.1	1073	15.3	1165
Information and communications technology professionals	15.5	495	17	543
Legal, social and cultural professionals	13.2	795	13.9	841
Science and engineering associate professionals	3	232	6	461
Health associate professionals	4.5	283	5.2	325
Business and administration associate professionals	8.8	1277	9.8	1429
Legal, social, cultural and related associate professionals	32	1396	32.8	1435

Scenario				
	Baseline		EGD scenario	
Occupation (ISCO 2 digit)	Employment change (in %)	Employment change (in 000s)	Employment change (in %)	Employment change (in 000s)
Information and communications technicians	5.9	101	7.1	121
General and keyboard clerks	-8.5	-521	-7.3	-449
Customer services clerks	20.1	893	21.4	952
Numerical and material recording clerks	-7.9	-570	-6.8	-491
Other clerical support workers	-13.8	-231	-13	-216
Personal service workers	4.7	490	5.3	553
Sales workers	3.1	465	3.8	568
Personal care workers	6.6	393	7	417
Protective services workers	-1.1	-37	-0.3	-11
Market-oriented skilled agricultural workers	-21.7	-1518	-21.4	-1497
Market-oriented skilled forestry, fishery and hunting workers	-11	-35	-11.1	-35
Subsistence farmers, fishers, hunters and gatherers	-26.2	-110	-26.3	-110
Building and related trades workers, excluding electricians	6.3	510	9.4	764
Metal, machinery and related trades workers	-9.1	-685	-8.1	-613
Handicraft and printing workers	-6.1	-68	-5.6	-63
Electrical and electronic trades workers	-0.9	-30	1.2	37
Food processing, wood working, garment and other craft and related trades	-10.5	-432	-10.1	-415

Scenario				
	Baseline		EGD scenario	
Occupation (ISCO 2 digit)	Employment change (in %)	Employment change (in 000s)	Employment change (in %)	Employment change (in 000s)
Stationary plant and machine operators	-5.3	-272	-4.3	-221
Assemblers	13.6	261	14.7	283
Drivers and mobile plant operators	0.9	80	3	261
Cleaners and helpers	2.4	195	3.1	252
Agricultural, forestry and fishery labourers	-6.1	-110	-5.7	-103
Labourers in mining, construction, manufacturing and transport	6.9	393	8.4	478
Food preparation assistants	4.6	75	5.4	87
Street and related sales and service workers	-15.3	-28	-15.3	-27
Refuse workers and other elementary workers	2.9	65	10.3	230

Source: Cedefop skills forecast, 2020 baseline and EGD scenario estimates.

ANNEX 2.

Assumptions underlying the EGD scenario in key policy areas

Power generation

(a) Coal phase out
(b) Nuclear capacity: same as in the baseline
(c) No assumptions on carbon capture and sequestration (CCS) but some response is expected as response to an increase in carbon price. There are no policies in the model to encourage CCS, but a higher ETS price makes the technology look less expensive, so it is possible for CCS capacity to start being built.
(d) Policies encouraging renewables
    (i) Subsidy support for certain (e.g. RES) electricity generating technologies
    (ii) Feed-in-tariffs (applied to current contracts only)
    (iii) Feed-in-premiums

Renewable in final use

(a) Household heating
    (i) subsidies for different types of heat pumps and solar thermal technologies, starting at half the capital cost in the first year of the policy, before being reduced to zero by 2030.
    (ii) small fuel tax on coal, oil and gas heating technologies, starting at just under 0.02% of the initial fuel cost and increasing to about 2.6% in 2030.
    (iii) at Member State level: setting a proportion of household heating that comes from district heating.
(b) Steel: At Member State level, setting a proportion of steel-making technologies using electricity (see fuel switching below)

(c) Fuel switching: replacing coal with electricity, gas or bioenergy in the production process of the following sectors: other chemicals; rubber and plastic products and other non-metallic mineral products; and basic metals metal products

Energy efficiency

(a) Reduction in energy demand
(b) Policies encouraging the change of technology toward less carbon-intensive fuels (see the list above)
(c) Energy efficiency investment is assumed to be privately funded, with no investment crowd-out in other sectors. The government covers the cost of the energy efficiency investment using the revenues from the ETS, and, where more money is required, by raising standard VAT

Transport

(a) Subsidies to support electric vehicles
(b) Various tax options for inefficient vehicles (such as fuel taxes, road taxes or registration taxes)
(c) No ban on diesel

Circular economy

(a) Increased recycling rates, particularly for sectors with high resource use such as electronics, plastics, textiles, construction and buildings, and food.
(b) End-of-life vehicles: it is assumed that dealerships take on the used vehicles and pass them on to recycling centres
(c) End-of-life batteries: it is assumed that the producers take on the used batteries and pass them on to recycling centres

For more information, please contact Cedefop.

EN

THE GREEN EMPLOYMENT AND SKILLS TRANSFORMATION

Insights from a European Green Deal skills forecast scenario

This report provides insight into likely employment and skills implications of the European Green Deal (EGD) based on a Cedefop skills forecast scenario. Implementing the EGD has a positive net employment impact. Employment effects appear to be concentrated in sectors directly targeted, such as extraction industries, construction and waste management. Employment increases are forecast in service sectors such as engineering and administration. In most other sectors, a possible redirection of employment towards cleaner production rather than an employment change is forecast. Policy needs to focus on extensive accelerating of up- and reskilling and providing guidance and support to workers who will need to change occupation, sector or geographic location. As well as targeted investment, developing transition-oriented skills matching approaches should also be a policy priority.

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