3 Skills for a net-zero future: Empowering communities for the green transition

This chapter illustrates economy-wide changes in labour markets and the demand for skills resulting from implementing policies aimed at reducing greenhouse gas emissions by considering the case of the European Union's Fit for 55 policy package. Overall employment is projected to increase between 2019 and 2030. However, projections indicate declining labour market opportunities for blue-collar workers and declining demand for skills involving the use of tools and technologies adopted in traditional manufacturing processes. By contrast, the demand for skills related to interpersonal communication and the use of digital technologies is projected to increase the most by 2030. Promoting societal-level resilience by reducing the carbon footprint of production should be accompanied by skills policies aimed at reducing workers' vulnerability to related transformations.

Key messages

If countries are to achieve ambitious climate targets alongside economic growth, climate policies will need to be accompanied by strong investments in skills policies. Skills policies, which comprise education and training policies targeted at both young people and adults, can play an essential role in ensuring that greening the economy does not lead to new forms of vulnerability and deprivation. Skills policies are an important component of efforts to ensure that the transition will be just and inclusive, leading to improvements in working conditions and minimising widespread job losses and contractual instability. Skills policies can facilitate the reallocation of workers away from sectors that will shrink because they are responsible for a large share of carbon dioxide (CO_2) emissions into sectors that will expand. To help workers effectively transition requires identifying not only economy-wide changes in skills demands but also the degree of similarity in the skill sets needed to perform different jobs, as well as projected trends in employment and the relative size of different employment opportunities.

This chapter considers the case of the European Union's Fit for 55 policy targets aimed at reducing greenhouse gas (GHG) emissions and, by employing novel data and methodologies, develops projections of the impact of the policy package on labour markets and the demand for skills. The case of the European Union (EU) is instructive because of the ambition of the policy package being implemented, the number of jurisdictions being affected and the availability of timely data to evaluate the potential impact of the policy on employment and the demand for skills. In particular, the chapter explores the effect of the Fit for 55 policy targets on five occupational categories: 1) technicians and associate professionals; 2) managers and professionals; 3) service and sales workers; 4) clerical workers; and 5) blue-collar and farm workers.

Key empirical findings include:

- Projections indicate that meeting ambitious climate targets of reducing CO_2 emissions by 55% by 2030 can be achieved, while overall employment increases by 1.3% in the Fit for 55 scenario between 2019 and 2030.
- By 2030, the employment of blue-collar and farm workers is projected to decrease by 3% in the Fit for 55 scenario (whereas it is projected to decrease by 2% in a scenario in which the policy was not implemented) and increase by 4-5% for other occupations.
- The skills categories that are projected to grow the most in demand according to the projections developed by the OECD between 2019 and 2030 with the implementation of the Fit for 55 policy include: interacting with computers; thinking creatively; analysing data and information; and communicating with persons outside an organisation, skills for which demand will grow as a result of the technological adoption.
- Other skills for which demand will increase include sales and marketing; computers and electronics; language; economics and accounting; customer and personal service; administration and management; and communications and media. Most of these skills are essential in the business services and public services sectors.
- Skills related to operating and maintaining equipment and tools are projected to decline the most in demand with the implementation of Fit for 55 targets.

3.1. Introduction

In response to deteriorating environmental conditions and mounting public pressure, in 2015, 196 Parties adopted the Paris Agreement, a legally binding international treaty on climate change with the goal to "limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels"

(United Nations Framework Convention on Climate Change, 2015[1]). Since adopting the Paris Agreement, many countries worldwide have implemented policy initiatives to reduce GHG emissions. Furthermore, the economic stimulus packages implemented to sustain economic growth following the coronavirus (COVID-19) pandemic and the energy crisis following Russia's war against Ukraine have served as a way to accelerate the twin digital and green transition.

Considering the impact of policies aimed at reducing GHG emissions on employment opportunities and skills demands is crucial to ensure long-term environmental sustainability. At the same time, if countries are to achieve ambitious climate targets alongside economic growth and high-quality working conditions, climate policies will need to be accompanied by strong investments in employment, social and skills policies to promote the socio-economic well-being of resident populations. Understanding the labour market impacts of greening policies is thus a key first step in preparing adequate policy responses to mitigate any adverse impacts the transition might have for certain population groups and ensuring that the green transition will be a just transition.

This chapter considers the role of skills policies in building resilience among affected communities based on a technical working paper that analyses the labour market and skills impacts of climate initiatives in the EU (Borgonovi et al., 2023[2]). The following countries were considered in the analysis: Austria, Belgium, Bulgaria, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Ireland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovenia, the Slovak Republic, Spain and Sweden. Although many countries have set climate targets, the EU has also ensured that the targets are binding by translating them into a set of legislative proposals that have been integrated into the Fit for 55 policy package.[1]

The Fit for 55 policy package sets an intermediate target of reducing net GHG emissions by at least 55% by 2030 compared to 1990 levels.[2] The package also indicates that the total emission reduction of 55% should be achieved with differentiations across sectors: emissions in sectors covered by the EU Emission Trading System (ETS) need to be reduced by 61% in 2030 compared to 2005 levels while emissions in other sectors – referred to as Effort Sharing Regulation (ESR) sectors – need to be reduced by 40% by 2030 compared to 2005 levels.

The Recommendation on ensuring a fair transition towards climate neutrality was adopted in 2022 to take into account the distributional implications of the transition. The Recommendation invites EU member states to adopt measures to address the employment and social aspects of climate, energy and environmental policies, encouraging the adoption of actions to support people most affected by the green transition, for instance, by stimulating the creation of quality jobs and facilitating access to safe working conditions protecting health and safety in the context of this green transition (Council of the European Union, 2022[3]). The Recommendation also puts a focus on education and training measures, inviting EU member states to integrate the employment and social aspects of the green transition in the development and implementation of relevant national strategies (Council of the European Union, 2022[3]). Other proposals concentrate on the fairness of tax-benefit and social protection systems and on ensuring access to affordable essential services and housing for people and households most affected by the green transition.

In recent years, a growing number of studies have attempted to estimate the effects climate change mitigation policies might have on labour markets, with the aim of identifying – and eventually preventing – potential mismatches arising from the reallocation of workers from sectors and occupations that are heavy emitters of GHG emissions into sectors and occupations that emit comparatively few GHG emissions – also referred to as "green" in the literature (Biagi, Vona and Bitat, 2021[4]). Such mismatches are likely to arise not only because of the geographical distribution and occupational composition of sectors that may grow or shrink as a result of structural transformations leading to increased environmental sustainability, but also because of the difference in the skill sets required to perform tasks prevalent in economic production processes characterised by high or low levels of GHG emissions.

The degree to which initial education, further education and training, and adult education will have to adapt largely depends on the degree to which the skills required are similar to or different from those that workers possess today. Therefore, minimising reallocation costs for individuals and societies crucially depends on adequately anticipating how similar the skills demanded of workers in a low-emission economy will be compared to the skills workers currently possess. Work-based learning and lifelong learning will play a crucial role, especially in the case of most affected workers in the declining industries. At the same time, work-based learning and lifelong learning will be critical to reduce shortages of workers to fill emerging opportunities in sectors that are rapidly expanding, such as in renewable energy production. Minimising reallocation costs also depends on using such information to inform the design of programmes in education and training systems so that they will effectively develop such skills. This will require potentially wide-ranging changes in school and vocational education and training curricula and, in turn, professional development for teachers and trainers (International Labour Organization, 2017[5]).

A growing body of literature has attempted to quantify the number of jobs aligned with achieving green objectives.[3] Although results from different studies are not directly comparable, as they often adopt different estimation methodologies and definitions, they generally indicate that only a small number of workers (between 1.5% and 4%) are employed in jobs directly aligned with the achievement of green objectives, such as those in renewable energy production.

Results from these studies can be used to map the skills needed in the small number of jobs that are well aligned with the achievement of green objectives. However, the transition to net zero will require economy-wide adaptations. Such adaptations will not only reduce employment in sectors that are heavy producers of CO_2 emissions and increase employment in carbon-neutral sectors but will also change the allocation of workers across and within sectors in all economic activities. Therefore, it is essential to conduct analyses of the current skills required for jobs directly related to achieving green objectives, along with projections of the skills demanded as employment undergoes structural transformations in the broader economy to meet economy-wide climate targets. Results from past modelling exercises conducted by the OECD suggest that implementing climate change mitigation policies will determine job destruction in fossil-fuel sectors and job creation in renewable energy sectors, which currently employ few workers overall.

This chapter presents a modelling analysis of the impacts of the Fit for 55 policy targets on labour markets, driven by the policy-induced changes in the structure of the economy. It distinguishes impacts by sector for five occupational categories: 1) “managers and professionals” (comprising “managers” and “professionals” in the International Standard Classification of Occupations [ISCO] classification); 2) “technicians and associate professionals” (comprising “technicians and associate professionals” in the ISCO classification); 3) “service and sales workers” (comprising “service and sales workers” in the ISCO classification); 4) “clerical workers” (comprising “clerical support workers” in the ISCO classification); and 5) “blue-collar and farm workers” (comprising “skilled agricultural”; “forestry and fishery workers”; “plant and machine operators, and assemblers”; “elementary occupations”; and “craft and related trades workers” in the ISCO classification). The choice to consider only five occupational groups was driven by model complexity but inevitably hides potentially large differences in trajectories within each group. Therefore, projections presented in this report should be accompanied by granular analyses to reflect geographical, sectoral and occupational differences.

An empirical analysis, based on matching labour market changes and occupations to skills information from positions advertised on line for different sectors, makes it possible to quantify the effects of the policy targets on the demand for skills.[4] Given the distribution of workers in 2019 in different EU countries, sectors and occupations, this chapter considers distributional implications and key target groups for the design of upskilling and reskilling interventions to facilitate the reallocation of workers across sectors and occupations that are projected to shrink and sectors and occupation that are projected to expand.

The modelling analysis relies on the OECD ENV-Linkages dynamic global Computable General Equilibrium (CGE) model (Chateau, Dellink and Lanzi, 2014[6]) to quantify the effect of policies on structural change, with a 2030 time horizon. The analysis compares a baseline scenario reflecting current policies, such as the ETS, with a Fit for 55 scenario.[5] The empirical analysis uses the job postings database for the 2019-22 period assembled by Lightcast (formerly known as Emsi Burning Glass) (Lightcast, n.d.[7]) to map the distribution of skills across sectors and occupations.

3.2. Projected employment changes resulting from the implementation of the Fit for 55 policy targets

The analysis of changes in sectoral employment relies on the OECD ENV-Linkages model to quantify the overall economy-wide effects of the mitigation policies needed to meet the Fit for 55 emission reduction targets. The main advantage of using a CGE model is that by exploiting its sectoral and regional dimensions, the analysis can consider the interlinkages between the economy's supply and demand sides, capturing adjustments to new policies in both quantities and prices. CGE models thus capture the changes in the prices of commodities, used as production inputs and for consumers, whether produced domestically or imported, and the shifts in demand and sourcing. Different studies can yield different projections depending on the specific model specifications, which can reflect different assumptions over the way in which policies may impact labour markets and be accompanied by additional policy action (Cedefop, 2021[8]; European Commission, 2023[9]).

The modelling analysis compares two scenarios: 1) a baseline scenario reflecting the implementation of current policies; and 2) a Fit for 55 scenario. The time horizon of the analysis extends to 2030, in line with the Fit for 55 targets. Specifically speaking:

- The **baseline scenario** reflects projected socio-economic trends as well as current policies. This scenario incorporates policies that were implemented by 2021[6] as well as policies that were by then already legislated but not yet implemented.[7] This approach is applied to EU countries and the rest of the world. The baseline scenario considers the EU carbon market, the ETS, which is already in place. This corresponds to the European Green Deal pre-Fit for 55 targets.
- In the **Fit for 55** scenario, the EU meets its target to reduce CO_2 emissions by 55% in 2030 compared to 1990 levels.[8] This economy-wide target is also specified for sectoral groups: an emission reduction of -61% in 2030 compared to 2005 in ETS sectors and -40% in ESR sectors (ESR sectors including all sectors outside of ETS).[9] Given that the scenario assumes a global transition, there is very limited potential for carbon leakage, so the Carbon Borden Adjustment Mechanism (European Commission, n.d.[10]) was not included in the analysis.

To ensure that the Fit for 55 package overall target is reached while also respecting the differentiation between the two sector groups, two separate carbon markets are included in the scenario and in the ENV-Linkages model: the ETS and a market for ESR sectors, covering all sectors of the economy.[10] When a policy is introduced in ENV-Linkages, the model adjusts its sectoral production and consumption patterns, including inputs and outputs, until a new equilibrium is reached.[11]

The Fit for 55 package is more stringent on ETS sectors, which are, on average, more emission intensive. There are also differences in labour intensity across sectors and, specifically, between ETS and ESR sectors. On average, ETS sectors are less labour intensive than ESR sectors. All together, ETS sectors accounted for less than 6% of total employment in the EU in 2019 (and 64% of emissions). In ETS sectors, most people are employed in other energy-intensive industries (e.g. steel, cement, glass, paper), representing around 3% of total employment (and 1% of emissions).

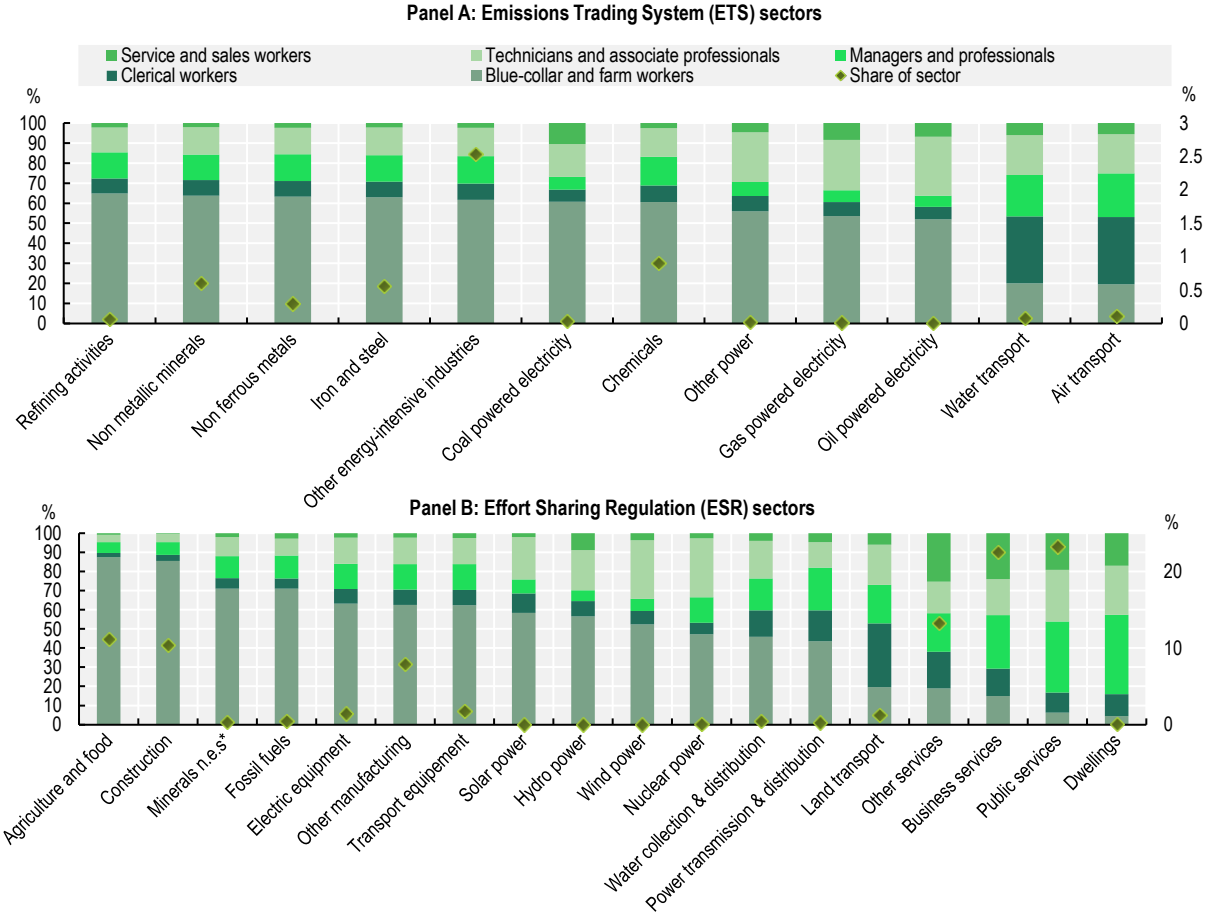
The distribution of workers across the five job categories also varies across sectors (Figure 3.1). ETS sectors rely most on blue-collar and farm workers, followed by technicians and associate professionals, and managers and professionals, with the exception of "air and water transport", which rely most on clerical

workers while also having a high share of managers and professionals. In ESR sectors, a salient difference appears between services sectors and other sectors (i.e. “agriculture”, “construction”, “manufacturing” and “other” sectors). Services sectors rely most on managers and professionals and have a low share of blue-collar and farm workers. Other sectors rely most on blue-collar and farm workers.

Managers and professionals, technicians and associate professionals”, and service and sales workers represent a larger share of total employment in ESR sectors (53% of total employment) than in ETS sectors (31% of total employment). Blue-collar and farm workers represent the largest share of employment in ETS sectors as well as a large share (24%) of employment in the construction sector (ESR sector), which has a relatively high employment level. Clerical workers represent 11% of total employment, with similar shares for ETS (9%) and ESR (11%) sectors. They are the most employed category in transport sectors, which, however, corresponds to a relatively low employment level (1.4% of total employment).

Figure 3.1. Employment level by occupational category and sector and employment share by sector, EU countries, 2019

Share of each occupational category in sectoral employment (left y-axis) and sectoral share in total employment (right y-axis)



Note: The figure shows the share of the five occupational categories in employment by sector. In parallel, it also shows the share of employment of each sector in total employment. An overview of all ENV-Linkages sectors displayed in this figure and how sectors are combined is provided in Borgonovi et al. (2023[2]).

* The abbreviation ‘n.e.s’ in the sector ‘Minerals n.e.s’ means “not elsewhere specified”.

Source: Calculations based on OECD ENV-Linkages model, in Borgonovi et al. (2023[2]), “The effects of the EU Fit for 55 package on labour markets and the demand for skills”, https://doi.org/10.1787/6c16baac-en.

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3.2.1. Impact of the Fit for 55 scenario

Sectoral production and CO_2 emissions

The Fit for 55 scenario achieves significant reductions in CO_2 emissions, reducing CO_2 emissions to 1.7 Gt (gigatonne) in 2030 from 3.3 Gt in 2019. Emissions are reduced in both EU-ETS (0.8 Gt in 2030, from 1.7 Gt in 2019) and ESR sectors (0.9 Gt in 2030, from 1.5 Gt in 2019), but the reduction in emissions is stronger in ETS sectors, in accordance with the Fit for 55 package targets.

The Fit for 55 scenario results in continued economic growth but also in a small reduction in the gross domestic product (GDP) for the EU (-3% in 2030) compared to the baseline scenario. This decrease is due to the fact that the OECD ENV-Linkages model is conservative on assumptions related to innovation. The modelling approach reflects the technological progress projected to take place in energy production and use, following the International Energy Agency's *World Energy Outlook 2021* (IEA, 2021[11]). However, the model does not explicitly include the possibility of innovation or further development of previously marketed technologies. With additional investments in research and development and assuming that these investments would result in faster technological development and innovation, reaching net-zero emissions by the middle of the century would be less costly and possibly also boost economic growth.

Sectoral production decreases most in sectors regulated by the ETS, especially coal, oil and gas-powered electricity, and air transport (Figure 3.2, Panel A).[12] These are some of the most emission-intensive sectors; therefore, reducing sectoral production contributes strongly to abating CO_2 emissions. Production losses are more limited in most ESR sectors (Figure 3.2, Panel B), except for mining and fossil fuels extraction and distribution, which are also emission-intensive sectors. Production substantially increases instead in renewable energy (solar, wind and hydro-powered electricity) and nuclear-powered electricity.

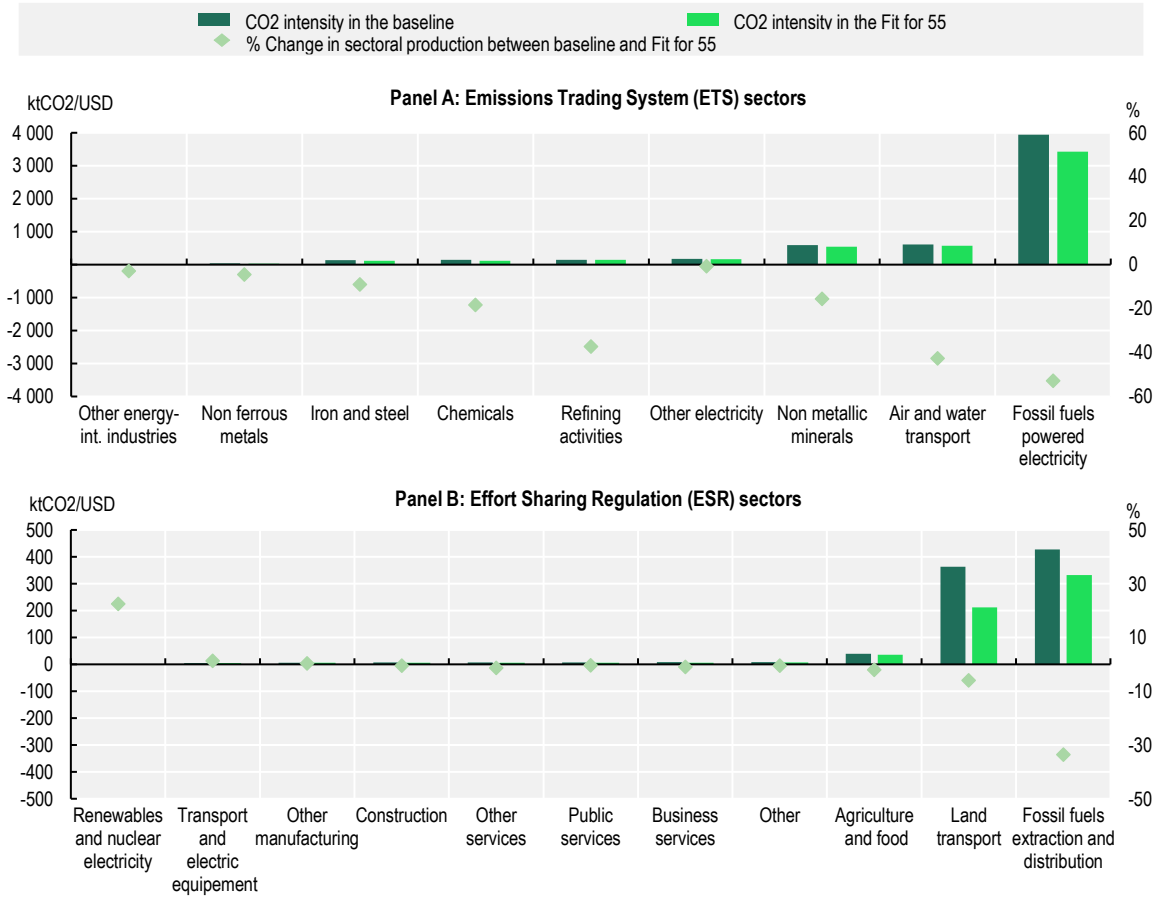
The Fit for 55 scenario also reduces the CO_2 intensity of key sectors compared to the baseline scenario. For ETS sectors, the largest decreases in CO_2 intensity take place in the production of "non-ferrous metals" (-25%), "chemicals" (-19%), "iron and steel" (-17%), as well as "other energy-intensive industries" (-19%) and other energy-intensive industries ("fossil-fuel-powered electricity": -13%).[13] In ESR sectors, CO_2 intensity decreases particularly for "land transport" (-41%), "fossil fuels extraction and distribution" (-22%) and the "services sectors".

Sectoral employment

The changes in the structure of the economy that follow the implementation of the Fit for 55 scenario lead to a reallocation of employment across sectors, which also results in a different distribution of employment across categories (Figure 3.3). Changes in sectoral employment result from two main interacting effects. First, changes in aggregate employment affect the size of the sectoral employment effects. In the baseline scenario, employment is projected to increase by 3% overall, compared to 2019. However, the contraction in GDP in the Fit for 55 scenario results in a lower increase in employment compared to 2019 (1.3%). This implies a decrease in employment by 2% in the Fit for 55 scenario in 2030 compared to the baseline. Second, the changes in the structure of the economy that follow the implementation of the Fit for 55 scenario lead to a reallocation of employment across sectors that accentuate the changes that already take place in the baseline scenario. Specifically, these include a switch from fuel-based energy towards renewable energy and a structural reallocation towards the service sectors. Together, these effects result in changes in employment by occupational category. In particular, the reorientation of the economy towards more labour-intensive sectors, in which blue-collar and farm workers represent a lower share of employment, is a key driver of the effects by occupational category. Employment decreases for blue-collar and farm workers compared to 2019 (-3%), while it increases for other categories (4-5%).

Figure 3.2. Change in sectoral production in the Fit for 55 scenario

CO_2 intensity in $ktCO_2$/USD (left y-axis) and % change sectoral production in USD millions (right y-axis) in 2030



Note: Sectors are ranked by CO_2 intensity in the baseline scenario. An overview of all ENV-Linkages sectors displayed in this figure and how sectors are combined is provided in Borgonovi et al. (2023[2]).

Source: Calculations based on OECD ENV-Linkages model, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

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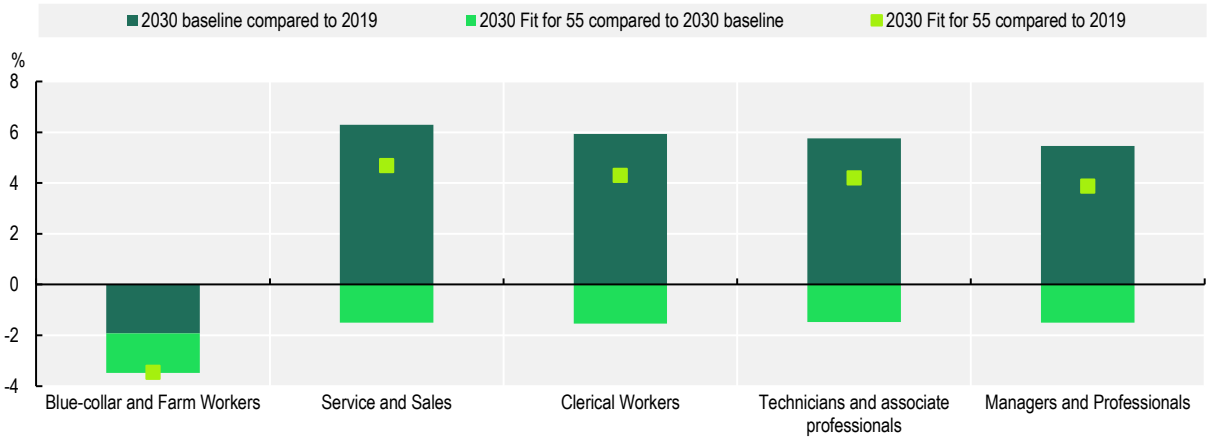
Figure 3.3. Employment in the Fit for 55 and baseline scenarios

% changes in employment compared to 2019



Note: The figure shows changes in employment in the baseline scenario from 2019 to 2030 (dark green bars), as well as the additional changes that take place in 2030 with the Fit for 55 scenario (light green bars). The figure also displays the overall net change in employment in the Fit for 55 scenario from 2019 to 2030 (markers).

Source: Calculations based on OECD ENV-Linkages model, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

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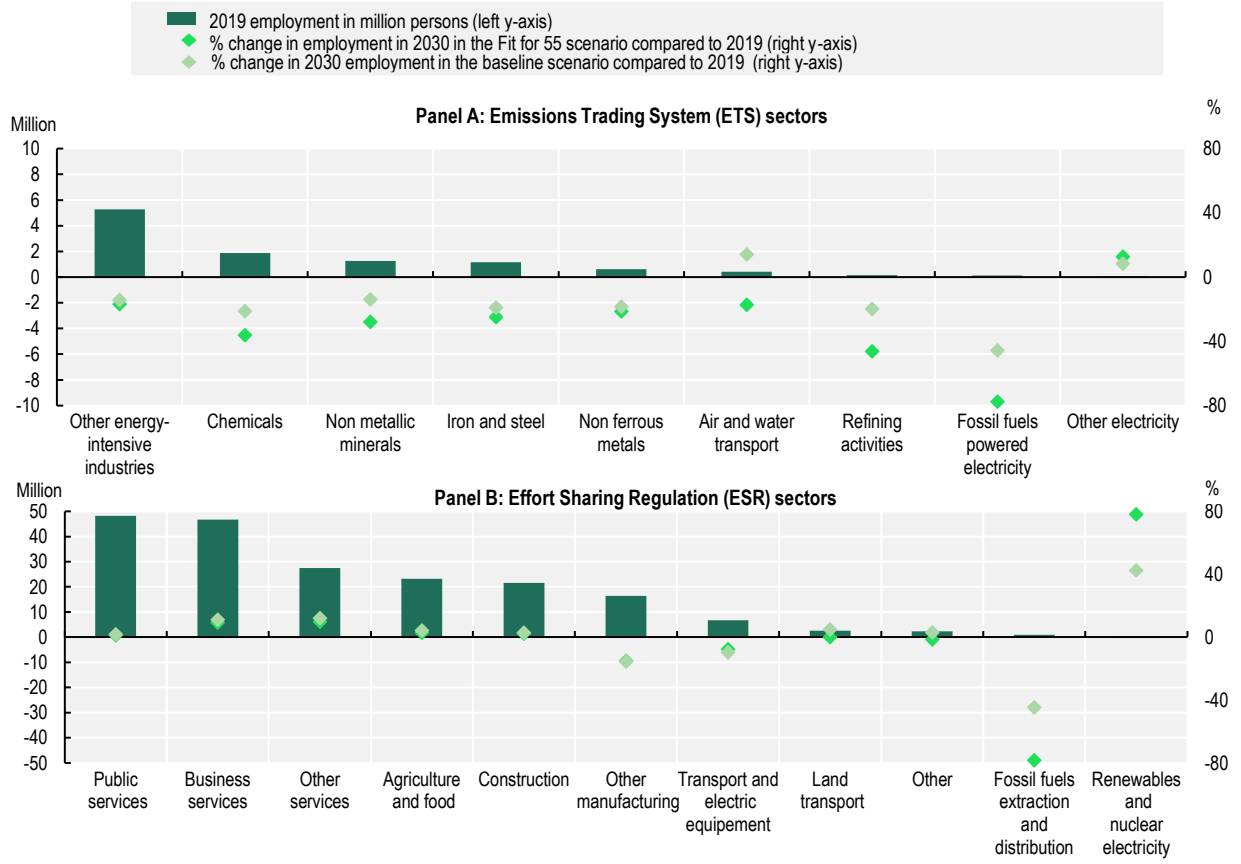
The changes in aggregate employment result from the reallocation of employment across sectors. In particular, employment increases significantly in sectors not covered by the ETS, where it grows by 3% between 2019 and 2030 in the Fit for 55 scenario (Figure 3.4). Employment increases in ESR high-employment sectors (6% in total services which include "public services", "business services" and "other services", and by 2% in "construction" between 2019 and 2030), except for "fossil fuels extraction and distribution" (-87%), "other manufacturing" sectors (-15%), "transport and electronic equipment" (-8%) and "other services" (e.g. minerals, -1%). Employment grows the most in "renewables and nuclear electricity" (78%) as well as "other services" (10%) and "business services" (9%). Employment decreases the most in fossil-based energy sectors, which the ETS covers. However, employment in these sectors accounts for less than 1% of total employment in the EU in 2030 in the Fit for 55 scenario; this decrease has a limited impact on overall employment. Overall, employment losses and gains will not be equally distributed across different sectors and occupations. In particular, sectors that will be most severely impacted in relative terms in terms of job creation and job destruction will be concentrated in sectors that currently employ relatively few workers and that pay relatively well. In contrast, sectors that currently employ many workers will be less affected by structural transformations. Job destruction will be especially large for blue-collar and farm workers.

Figure 3.4. Evolution in sectoral employment in the Fit for 55 scenario



Note: Sectors are ranked by employment in 2019 (bars). The markers illustrate changes in employment in 2030 compared to 2019 for the baseline scenario (light green markers) and the Fit for 55 scenario (dark green markers). An overview of all ENV-Linkages sectors displayed in this figure and how sectors are combined is provided in Borgonovi et al. (2023[2]).

Source: Calculations based on OECD ENV-Linkages model, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

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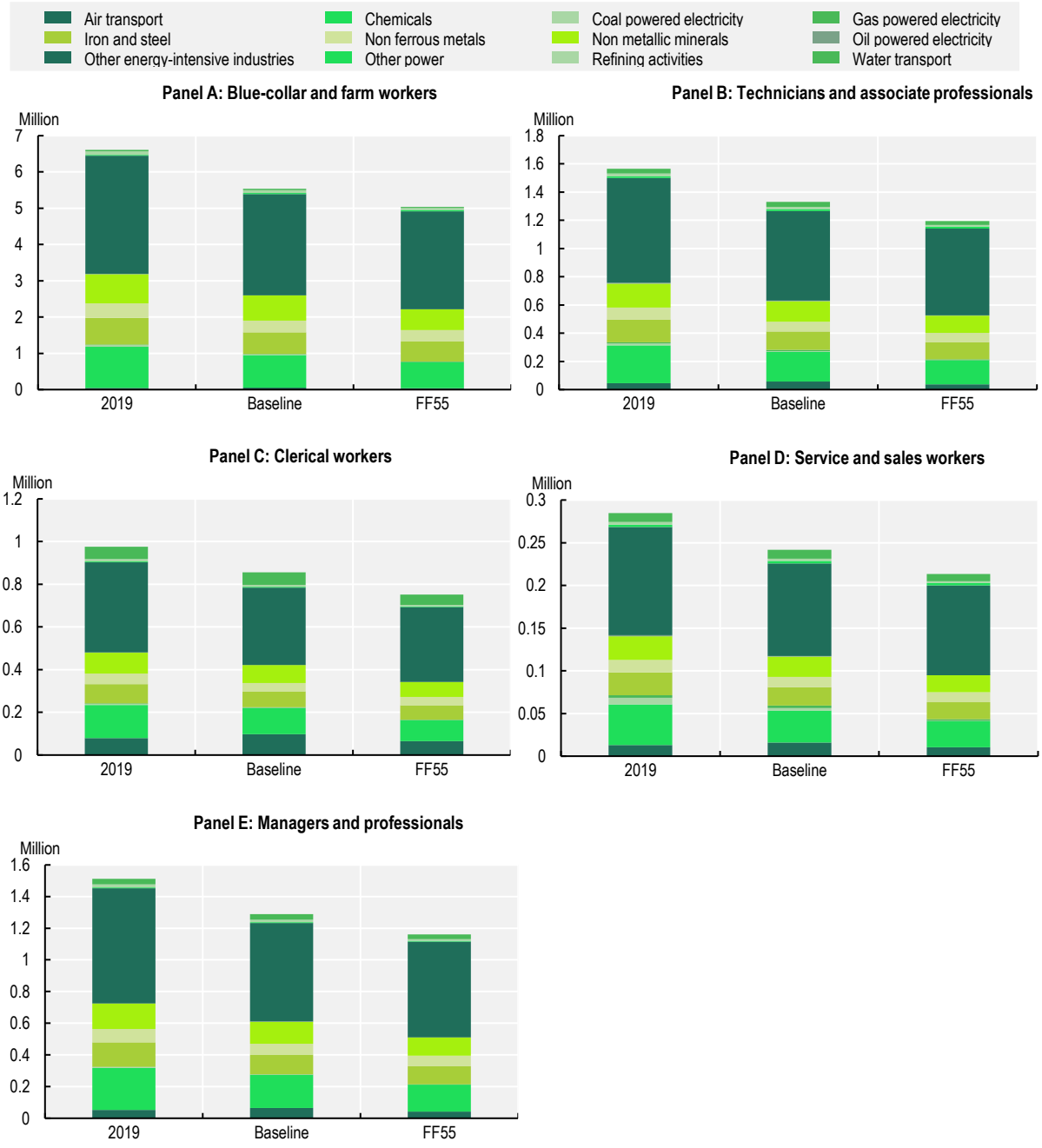
Sectoral employment by occupational category

With the Fit for 55 package, employment in the EU by 2030 increases in all job categories except for blue-collar and farm workers (Figure 3.5 provides ETS sectors, while Figure 3.6 provides ESR sectors). While employment remains at a similar level for this occupational category between 2019 and 2030 for ESR sectors (-0.1%), it decreases strongly for ETS sectors (-24%). For all other categories, the increase in employment in ESR sectors compensates for the decrease in ETS sectors. Employment increases for service and sales workers, managers and professionals, clerical workers, and technicians and associate professionals as these categories are most employed in sectors with a large share of total employment (services sectors) and/or in sectors in which employment increases the most between 2019 and 2030 (renewables and nuclear electricity).

Figure 3.5. Sectoral employment by occupational category, ETS sectors

Employment level in 2019 and in 2030 for the Fit for 55 and baseline scenarios (in million persons)



Note: For each occupational category, the figure illustrates total employment for ETS sectors, for the base year (2019), and the Fit for 55 and baseline scenarios in 2030.

Source: Calculations based on OECD ENV-Linkages model, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

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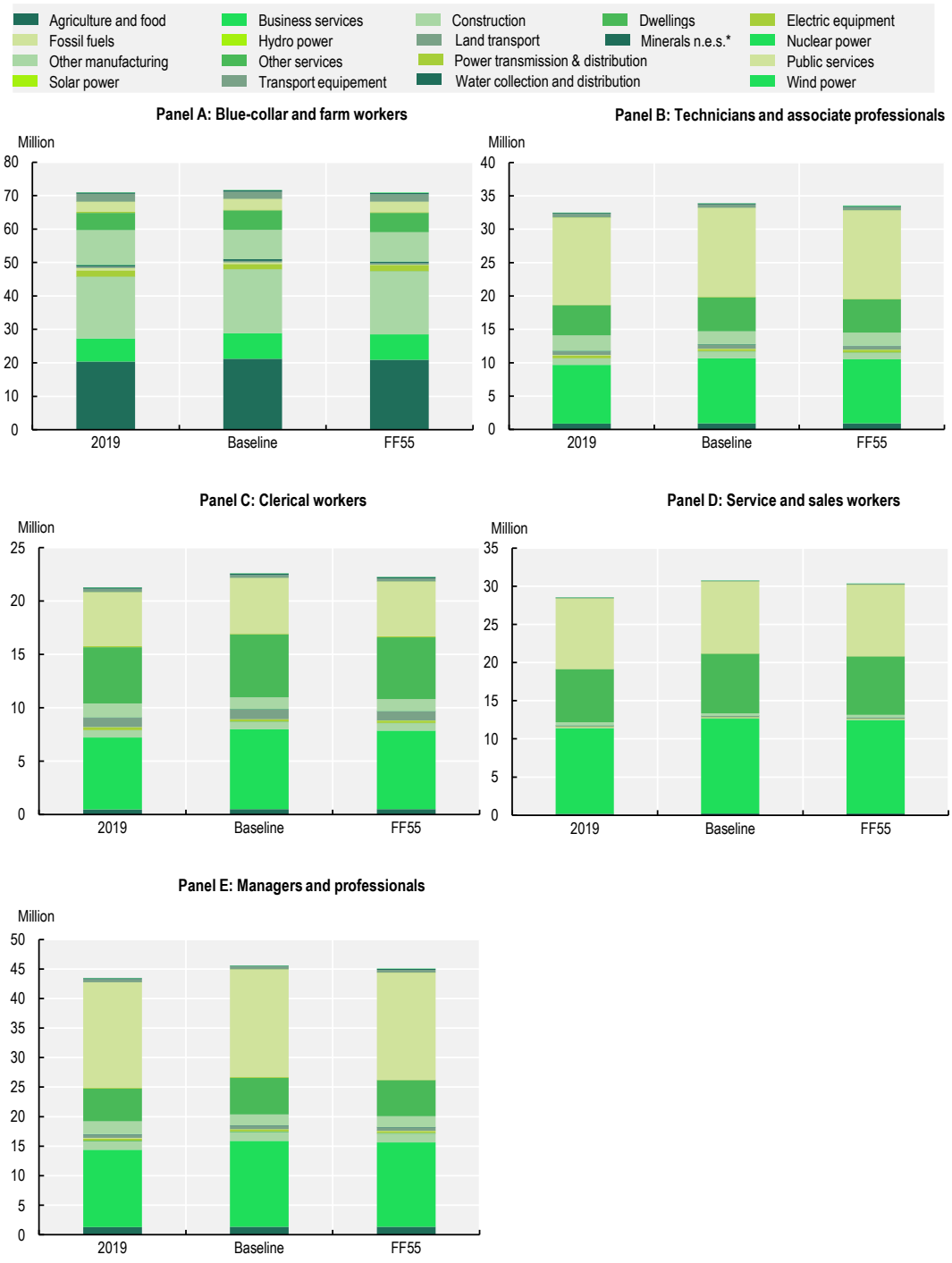
Figure 3.6. Sectoral employment by occupational category, ESR sectors

Employment level in 2019 and in 2030 for the Fit for 55 and baseline scenarios (in million persons)



Note: For each occupational category, the figure illustrates total employment for ESR sectors, for the base year (2019), and the Fit for 55 and baseline scenarios in 2030.
* The abbreviation 'n.e.s' in the sector 'Minerals n.e.s' means "not elsewhere specified".
Source: Calculations based on OECD ENV-Linkages model, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

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3.3. Projected changes in the demand for skills

Projected changes in employment across sectors and occupations will be reflected in changes in the demand for skills. Emerging skill requirements of jobs in different sectors and occupations were measured using information available in European online vacancies from Lightcast, an approach also used in other studies that consider the effect on skill demands of climate change mitigation policies in Europe (Cedefop, 2023[12]).[14] The importance of a specific skill in a specific sector-by-occupation category was inferred by considering whether such a skill was more frequently found in job vacancies in that sector-by-occupation category compared to how frequently other skills are found in job vacancies in that sector-by-occupation category and how frequently such a skill is found in vacancies in other sector-by-occupation categories. Skills requirements were then multiplied by employment numbers in different sectors and occupations in 2019 as well as projections in 2030 under the baseline and the Fit for 55 scenarios to identify overall skills demands in different scenarios.

An important caveat of estimates of the skills content of occupations is that estimates have ordinal but not numerical meaning. Therefore, whereas it is possible to describe which skills are projected to increase the most and consider if differences in projected growth under different scenarios for one skill are larger or smaller than those projected for a different skill, it is not possible to say if a skill is projected to grow by a given percentage or, for example, double in demand. However, estimates reflect that if demand is projected to increase or decrease, projected changes can be ranked and grouped into projected growth quartiles. Rank positions and quartiles of growth were used in the following analyses to describe projected changes in skills demand.

Contrary to most empirical work that assumes that the skill requirements of occupations in different countries reflect the skill requirements observed in the United States specified in the context of the O*NET database, in this work, emerging skill requirements contained in job postings for the EU region were used. The use of skills requirements specified in online job vacancies also allows for a better approximation of the emerging skills content of different occupations, given the intention of this work to consider projected changes in skills demands related to structural transformations in production processes to meet ambitious environmental policy targets rather than mapping the distribution of skill requirements in the past in different occupations. To aid comparability with other work, such as the OECD Skills for Jobs database (OECD, 2022[13]), skill requirements expressed in the European Skills, Competences, Qualifications and Occupations (ESCO) taxonomy were mapped onto the O*NET classification.

The detailed skills classifiers contained in job vacancies were aggregated into six main skills categories according to the O*NET system: *Skills*; *Knowledge*; *Abilities*; *Technology Skills and Tools*; *Work Activities*; and *Work Styles* (a detailed description of the skills categories is provided in Borgonovi et al. (2023[2])).[15] To avoid confusion between individual skills and the broad *Skills* category, whenever referring to a specific aggregate category of skills, italics are applied. By contrast, the term skills, not italicised, refers to all the categories together and general human capital.

In particular, because Figure 3.4 reveals that sectors that employ few people, such as “fossil-fuel-powered electricity” and “renewables and nuclear energy” generation, are projected to be highly impacted (some negatively and others positively) by implementing Fit for 55, two sets of analyses were developed. The first compares changes in skills demands considering the change in the absolute number of workers employed in different sectors and occupations in 2030 compared to 2019. The second compares changes in skills demands considering the percentage-point change in the number of workers employed in different sectors and occupations in 2030 compared to 2019.

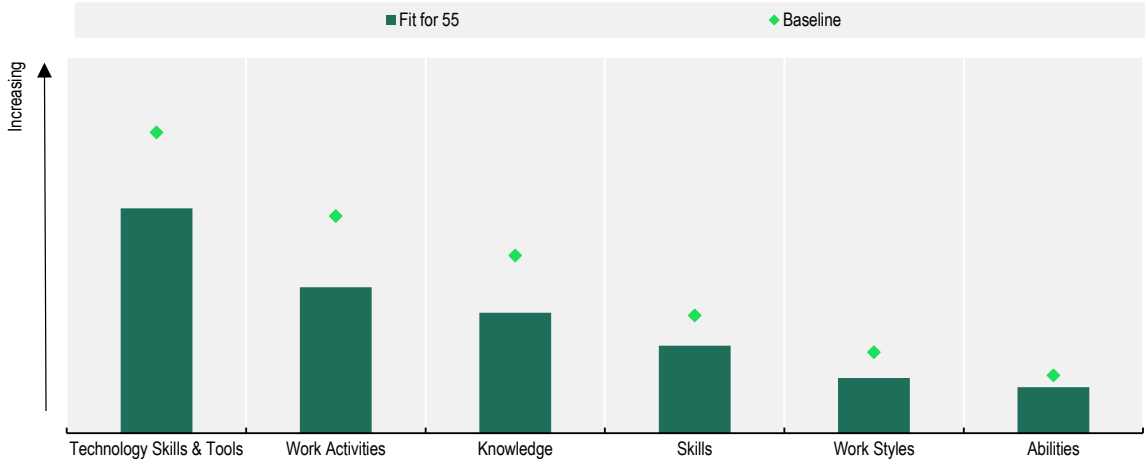
Because under the Fit for 55 scenario, employment is projected to be lower (1.3% versus 3%) than in the baseline scenario (Figure 3.3), changes in skills categories based on relative and absolute changes in employment presented in the following section reveal a weaker demand for all skills categories in the Fit for 55 scenario than the baseline scenario. The difference between the two scenarios in projections for

different skills categories reflects the different demand for skills in each of the six categories in sectors and occupations with different projected growth rates in the two scenarios.

In Figure 3.7, **relative** changes in the absolute number of workers employed in different sectors between 2019 and 2030 are used to estimate changes in the demand for skills. Relative changes correspond to the projected percentage changes in employment by 2030 under the Fit for 55 and baseline scenarios over 2019 employment levels. The skills categories that are projected to grow the most in demand are *Technology Skills and Tools*, and *Work Activities*. These are the skills categories grouping a large number of skills that are used in particular in occupations and sectors that are projected to grow sharply between 2019 and 2030.

Figure 3.7. Projected change in the demand for skills between 2019 and 2030 when considering relative growth in employment, by main skill category

Estimated change in the demand for skills given projections in relative employment growth in different sectors and occupations in the Fit for 55 and baseline scenarios



Note: The figure shows the projected change in the demand for each of the six main skills categories between 2019 and 2030 under the Fit for 55 and baseline scenarios across European Union countries when considering relative employment growth in different sectors and occupations identified in the section above, "Projected employment changes resulting from the implementation of the Fit for 55 policy targets". A detailed description of the underlying analyses is provided in Borgonovi et al. (2023[2]).
Source: Calculations based on OECD ENV-Linkages model, Lightcast (2023[14]), Lightcast™, https://lightcast.io/, (accessed April 2023), European Union (2019[15]), European Labour Force Survey, ad hoc data extraction (for the year 2019), https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

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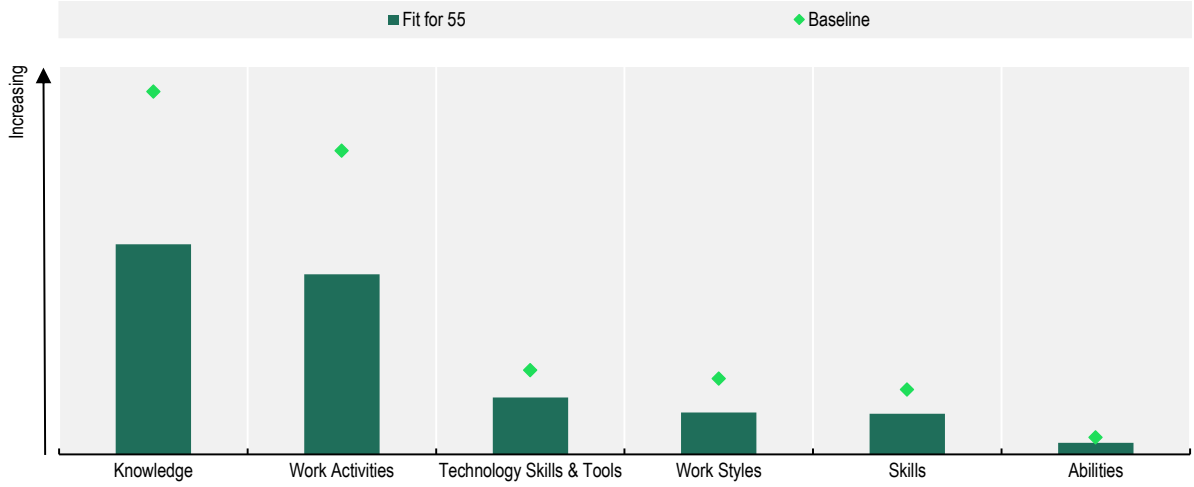
Projected changes in the **absolute** number of workers employed in different sectors between 2019 and 2030 are used to estimate changes in the demand for skills in Figure 3.8. *Knowledge* and *Work Activities* are the skills categories that are projected to grow most sharply, whereas *Skills* and *Abilities* are projected to grow the least between 2019 and 2030.

Figure 3.8. Projected change in the demand for skills between 2019 and 2030 when considering absolute changes in employment, by main skill category

Estimated change in the demand for skills given projections in absolute employment change in different sectors and occupations in the Fit for 55 and baseline scenarios



Note: The figure shows the projected change in the demand for each of the six main skills categories between 2019 and 2030 under the Fit for 55 and baseline scenarios across European Union countries when considering absolute employment growth in different sectors and occupations identified in the section above, "Projected employment changes resulting from the implementation of the Fit for 55 policy targets". A detailed description of the underlying analyses is provided in Borgonovi et al. (2023[2]).
Source: Calculations based on OECD ENV-Linkages model, Lightcast (2023[14]), Lightcast™, https://lightcast.io/, (accessed April 2023), European Union (2019[15]), European Labour Force Survey, ad hoc data extraction (for the year 2019), https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

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Table 3.1 categorises all skills demanded in online vacancies into five groups. The first four groups reflect quartiles of projected skills growth between 2019 and 2030 under the Fit for 55 scenario, with Group 1 being composed of the 25% of skills that are projected to increase the most in demand. Group 4 comprises the 25% of skills that are projected to increase the least in demand. Group 5 comprises all skills that are projected to decline in demand under the same scenario. Projections in demand were obtained by multiplying changes in absolute employment numbers between 2019 and 2030 in the Fit for 55 scenario.

As many as 11 skills out of the 32 skills in the *Knowledge* category (or around 34%) are projected to be in the group of skills with the strongest **estimated demand increase** (Group 1). Examples of these skills are: "sales and marketing", "computers and electronics", "language", "economics and accounting", "customer and personal service", "administration and management", "medicine and dentistry", "production and processing", "communications and media", "personnel and human resources", and "food production". Most of these skills are essential in the "business services" and "public services" sectors, which employ many workers in EU economies.

A further 11 of the 32 skills in the *Knowledge* category (or around 34%) are projected to be in Group 2. These are: "law and government", "chemistry", "biology", "public safety and security", "engineering and technology", "administrative", "mathematics", "building and construction", "psychology", "education and training", and "geography". Only four skills in the *Knowledge* category are projected to **decline in overall demand** or be in the group of skills that are estimated to grow the least in demand.

Table 3.1. Projected change in the demand for skills between 2019 and 2030 under the Fit for 55 scenarios

Group 1: Top quartile of absolute increase	Group 2: Second quartile of absolute increase	Group 3: Third quartile of absolute increase	Group 4: Bottom quartile of absolute increase	Group 5: Skills declining in demand
Oral expression	Originality	Mathematical reasoning	Memorisation	Physics
Sales and marketing	Fluency of ideas	Fine arts	Written comprehension	Mechanical
Computers and electronics	Law and government	Transportation	Information ordering	Repairing
Language	Chemistry	Philosophy and theology	Therapy and counselling	Equipment maintenance
Economics and accounting	Biology	History and archaeology	Design	Offset printing presses
Customer and personal service	Public safety and security	Telecommunications	Systems evaluation	Injection moulding machines
Administration and management	Engineering and technology	Sociology and anthropology	Service orientation	Computer-aided manufacturing (CAM) software
Medicine and dentistry	Administrative	Judgement and decision making	Active listening	Lasers
Production and processing	Mathematics	Management of material resources	Critical thinking	Milling machines
Communications and media	Building and construction	Management of personnel resources	Resource management skills (general)	Handling and moving objects
Personnel and human resources	Psychology	Monitoring	Programme testing software	Repairing and maintaining mechanical equipment
Food production	Education and training	Systems analysis	Music or sound editing software	Repairing and maintaining mechanical equipment
Programming	Geography	Graphics or photo imaging software	Metadata management software	Controlling machines and processes
Time management	Management of financial resources	Database user interface and query software	Automatic teller machines (ATMs)	
Web platform development software	Complex problem solving	Enterprise application integration software	Information retrieval or search software	
Operating system software	Quality control analysis	Web page creation and editing software	Cloud-based data access and sharing software	
Analytical or scientific software	Database management system software	Spreadsheet software	Business intelligence and data analysis software	
Interacting with computers	Object or component-oriented development software	Internet browser software	Geographic information system	
Thinking creatively	Office suite software	Desktop publishing software	Access servers	
Analysing data or information	Configuration management software	Computer-based training software	Word processing software	
Assisting and caring for others	Development environment software	Inspecting equipment, structures, or material	Computer-aided design (CAD) software	
Communicating with persons outside an organisation	Enterprise resource planning (ERP) software	Operating vehicles, mechanised devices, or equipment	Optical character reader (OCR) or scanning software	
Performing general physical activities	Customer relationship management (CRM) software	Scheduling work and activities	Network monitoring software	

Group 1: Top quartile of absolute increase	Group 2: Second quartile of absolute increase	Group 3: Third quartile of absolute increase	Group 4: Bottom quartile of absolute increase	Group 5: Skills declining in demand
Provide consultation and advice to others	Application server software	Identifying objects, actions, and events	Transaction security and virus protection software	
Guiding, directing, and motivating subordinates	Presentation software	Training and teaching others	Video creation and editing software	
Performing administrative activities	Documenting/recording information	Coaching and developing others	Object-oriented database management software	
Establishing and maintaining interpersonal relationships	Communicating with supervisors, peers, or subordinates	Getting information	Safety harnesses or belts	
Organising, planning, and prioritising work	Performing for or working directly with the public	Evaluating information to determine compliance with standards	Blow moulding machines	
Selling or influencing others	Judging the qualities of things, services, or people	Developing and building teams	Compliance software	
Monitoring and controlling resources	Staffing organisational units	Updating and using relevant knowledge	Interpreting the meaning of information for others	
Developing objectives and strategies	Monitor processes, materials, or surroundings	Stress tolerance	Processing information	
Making decisions and solving problems	Resolving conflicts and negotiating with others	Concern for others	Repairing and maintaining electronic equipment	
Dependability	Self-control	Attention to detail	Estimating the quantifiable characteristics of products, events, or information	
Initiative	Analytical thinking	Co-operation	Co-ordinating the work and activities of others	
Achievement/effort	Adaptability/flexibility	Innovation	Integrity	
Leadership			Persistence	

Note: Individual skills are grouped into five groups depending on the size of projected changes in demand between 2019 and 2030 under the Fit for 55 scenario. Each skill is assigned a colour depending on the skill category to which the skill belongs. Estimates of changes in skills demands were computed by multiplying the calculated importance of a specific skill with overall employment numbers in 2019 and in 2030 under the Fit for 55 Scenario.

- Abilities
- Knowledge
- Skills
- Technology Skills and Tools
- Work Activities
- Work Styles

Source: Calculations based on OECD ENV-Linkages model, Lightcast (2023[14]), Lightcast™, https://lightcast.io/, (accessed April 2023), European Union (2019[15]), European Labour Force Survey, ad hoc data extraction (for the year 2019), https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

Many of the skills in the *Work Activities* category are also estimated to be in the **largest increase group**. Table 3.1 indicates that 15 of the 41 skills in the *Work Activities* category are in the largest increase group (around 38% of all skills in the *Work Activities* category). Examples of *Work Activities* skills that are **estimated to grow the most in demand** (Group 1) include: "interacting with computers"; "thinking creatively"; "analysing data and information"; "assisting and caring for others"; "communicating with persons outside an organisation"; "performing general physical activities"; "providing consultation and advice to others"; "guiding, directing, and motivating subordinates"; "performing administrative activities"; "establishing and maintaining interpersonal relationships"; "organising, planning, and prioritising work";

"selling or influencing others"; "monitoring and controlling resources"; "developing objectives and strategies"; and "making decisions and solving problems".

By contrast, only three skills in the *Work Activities* category out of 41 (around 10%) are projected to decline in demand. These are: "handling and moving objects"; "repairing and maintaining mechanical equipment"; and "controlling machines and processes".

Among the 44 skills identified in the *Technology Skills and Tools* category, 3 (corresponding to 7% of all skills in the *Technology Skills and Tools* category) belong to the set of skills that are projected to **grow the most in demand** (Group 1) between 2019 and 2030. These are: "web platform development software"; "operating system software"; and "analytical or scientific software". As many as 19 skills (corresponding to 43%) belong to the set of skills that are projected to grow the least in demand between 2019 and 2030, and 5 skills are projected to decline in demand (11%). These include: "offset printing presses"; "injection moulding machines"; "computer-aided manufacturing (CAM) software"; "operating lasers"; and "operating milling machines".

Among the *Skills* category, two skills, namely programming and time management (corresponding to 12% of skills in the *Skills* category), are in the group of skills that are projected to **increase the most in demand**, whereas repairing and equipment maintenance are in the set of skills that are projected to decline in demand.

"Oral expression" is the only skill in the *Abilities* category estimated to be in the group of skills projected to **increase the most in demand**. "Originality" and "fluency of ideas" are in the second group of increased demand. In contrast, "memorisation", "written comprehension", and "information ordering" are estimated to be in the group of skills projected to increase the least in demand.

Table 3.2 complements estimates in Table 3.1 by illustrating which skills will contract the most in demand with the implementation of Fit for 55 targets relative to the baseline scenario. Whereas most skills in Table 3.1 are projected to increase between 2019 and 2030, all skills in Table 3.2 are projected to decline in demand because, in virtually all sectors and occupations, Fit for 55 will determine a contraction in employment relative to the baseline scenario.

Most of the skills projected to decline the most in demand as a result of the implementation of Fit for 55 targets refers to operating and maintaining equipment and tools. They include skills such as "controlling machines and processes"; "operating injection moulding machines"; "repairing"; "physics"; "handling and moving objects"; "repairing and maintaining mechanical equipment"; "estimating the quantifiable characteristics of products, events, or information"; "equipment maintenance"; "blow moulding machines".

By contrast, many of the skills projected to be impacted the least with the contraction of employment due to Fit for 55 are: "mathematical reasoning"; "using video creation and editing software"; "programme testing software"; "network monitoring software"; "persistence"; "management of personnel resources"; "business intelligence and data analysis software"; "transaction security and virus protection software"; "co-ordinating the work and activities of others"; and "presentation software".

Although the demand for most skills is projected to increase in absolute terms between 2019 and 2030 under the implementation of the Fit for 55 targets (Table 3.1), such an increase is lower than the increase projected under the baseline scenario since overall employment projections are lower in the Fit for 55 than in the baseline scenario. At the same time, the effect of the Fit for 55 implementation is not equal across sectors and occupations, so the contracting effect of Fit for 55 on skills demand varies depending on whether skills are especially used in sectors and occupations that will be most severely impacted by Fit for 55 or not (Table 3.2).

Table 3.2. How the demand for skills will be impacted by implementing Fit for 55

Top quartile of change in demand due to FF55 relative to baseline (Skills for which Fit for 55 is projected to have the weakest negative effect on skills demand)	Second quartile of change in demand due to FF55 relative to baseline	Third quartile of change in demand due to FF55 relative to baseline	Bottom quartile of change in demand due to FF55 relative to baseline (Skills for which Fit for 55 is projected to have the strongest negative effect on skills demand)
Information ordering	Fluency of ideas	Oral expression	Written comprehension
Mathematical reasoning	Economics and accounting	Originality	Language
Memorisation	Medicine and dentistry	Administrative	Building and construction
Sociology and anthropology	Food production	Mathematics	Production and processing
History and archaeology	Fine arts	Personnel and human resources	Transportation
Service orientation	Sales and marketing	Philosophy and theology	Engineering and technology
Management of personnel resources	Public safety and security	Computers and electronics	Design
Critical thinking	Psychology	Telecommunications	Physics
Active listening	Communications and media	Law and government	Mechanical
Systems evaluation	Biology	Chemistry	Quality control analysis
Offset printing presses	Education and training	Therapy and counselling	Complex problem solving
Network monitoring software	Geography	Management of material resources	Equipment maintenance
Geographic information system	Customer and personal service	Time management	Resource management skills (general)
Program testing software	Administration and management	Enterprise resource planning (ERP) software	Repairing
Video creation and editing software	Programming	Object-oriented database management software	Information retrieval or search software
Enterprise application integration software	Management of financial resources	Graphics or photo imaging software	Word processing software
Compliance software	Systems analysis	Computer-based training software	Spreadsheet software
Database management system software	Judgement and decision making	Automatic teller machines (ATMs)	Blow moulding machines
Business intelligence and data analysis software	Monitoring	Optical character reader (OCR) or scanning software	Internet browser software
Access servers	Web platform development software	Office suite software	Lasers
Transaction security and virus protection software	Object or component-oriented development software	Assisting and caring for others	Computer-aided design (CAD) software
Safety harnesses or belts	Customer relationship management (CRM) software	Judging the qualities of things, services, or people	Injection moulding machines
Presentation software	Milling machines	Thinking creatively	Computer-aided manufacturing (CAM) software
Desktop publishing software	Development environment software	Performing general physical activities	Inspecting equipment, structures, or material
Metadata management software	Web page creation and editing software	Establishing and maintaining interpersonal relationships	Repairing and maintaining electronic equipment
Configuration management software	Analytical or scientific software	Documenting/recording information	Monitor processes, materials, or surroundings
Music or sound editing software	Cloud-based data access and sharing software	Training and teaching others	Operating vehicles, mechanised devices, or equipment

Top quartile of change in demand due to FF55 relative to baseline (Skills for which Fit for 55 is projected to have the weakest negative effect on skills demand)	Second quartile of change in demand due to FF55 relative to baseline	Third quartile of change in demand due to FF55 relative to baseline	Bottom quartile of change in demand due to FF55 relative to baseline (Skills for which Fit for 55 is projected to have the strongest negative effect on skills demand)
Operating system software	Guiding, directing, and motivating subordinates	Interacting with computers	Developing and building teams
Application server software	Coaching and developing others	Monitoring and controlling resources	Getting information
Database user interface and query software	Provide consultation and advice to others	Interpreting the meaning of information for others	Processing information
co-ordinating the work and activities of others	Selling or influencing others	Organising, planning, and prioritising work	Estimating the quantifiable characteristics of products, events, or information
Identifying objects, actions, and events	Developing objectives and strategies	Evaluating information to determine compliance with standards	Repairing and maintaining mechanical equipment
Resolving conflicts and negotiating with others	Communicating with supervisors, peers or subordinates	Self-control	Repairing and maintaining mechanical equipment
Staffing organisational units	Scheduling work and activities	Attention to detail	Handling and moving objects
Performing administrative activities	Communicating with persons outside an organisation	Initiative	Controlling machines and processes
Performing for or working directly with the public	Making decisions and solving problems	Leadership	Dependability
Analysing data or information	Updating and using relevant knowledge	Achievement/effort	Integrity
Persistence	Analytical thinking	Concern for others	Stress tolerance
Innovation			Adaptability/flexibility
			Co-operation

Note: Individual skills are grouped into four groups depending on the size of the difference in projected skills demands in 2030 under the Fit for 55 scenario and the baseline scenario. Each skill is assigned a colour depending on the skill category to which the skill belongs. Estimates of changes in skills demands were computed by multiplying the calculated importance of a specific skill with the percentage change in employment numbers in 2030 under the Fit for 55 and the baseline scenario.

- Abilities
- Knowledge
- Skills
- Technology Skills and Tools
- Work Activities
- Work Styles

Source: Calculations based on OECD ENV-Linkages model, Lightcast (2023[14]), Lightcast™, https://lightcast.io/, (accessed April 2023), European Union (2019[15]), European Labour Force Survey, ad hoc data extraction (for the year 2019), https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

3.3.1. Similarity in the skill set of workers employed in different sectors and occupations

In order to facilitate the successful transition of workers from sectors expected to contract in the next decade to sectors expected to grow, it is necessary to develop training opportunities. This requires identifying both the overall changes in skills demanded across the economy and the extent to which different jobs share similar skill requirements. Additionally, projected employment trends and the relative scale of various employment opportunities need to be considered. Jobs that are growing very rapidly in demand but are small in size might, in fact, offer fewer transition opportunities than jobs that are growing little in demand but represent a large share of the overall labour market.[16]

Even after having identified the skills that adults should acquire to successfully transition into occupations or sectors that will expand in the medium term, a major challenge is to ensure that education and training systems are designed in a flexible way to enable smooth transitions. This requires adult education and training systems to have a certain degree of flexibility with respect to several dimensions: time (when does learning occur and for how long), place (where does learning occur), mode (which learning style) and content (which skills to learn) (OECD, 2023[16]). However, many adult education and training systems are not yet developed to meet these challenges. Scope for improvement exists in many areas, such as the recognition of prior learning (OECD, 2019[17]), which is also closely linked to occupational entry regulations and, for example, has implications for labour mobility (von Rueden and Bambalaite, 2020[18]); ensuring inclusiveness of learning systems. To date, a large share of workers still does not participate in training (OECD, 2019[17]).

Blue-collar and farm work occupations are projected to shrink in overall demand (Figure 3.3) in the Fit for 55 and baseline scenarios. As a result, many existing blue-collar and farm workers will have to consider transitioning into non-blue-collar and farm work occupations and initial education and training. Therefore, young people should be made aware of shrinking/increasing labour market opportunities while they are in initial education and training, and such information should be reflected in orientation programmes to help them make educational and career decisions that are aligned with labour market needs. At the same time, blue-collar and farm work will not disappear, and there are sectors in which demand is projected to increase. Identifying the degree of similarity in the skills required in different sectors and occupations and their capacity to absorb new workers due to labour market trends can aid both individuals who consider transition opportunities and policy makers in organising effective upskilling and reskilling programmes.

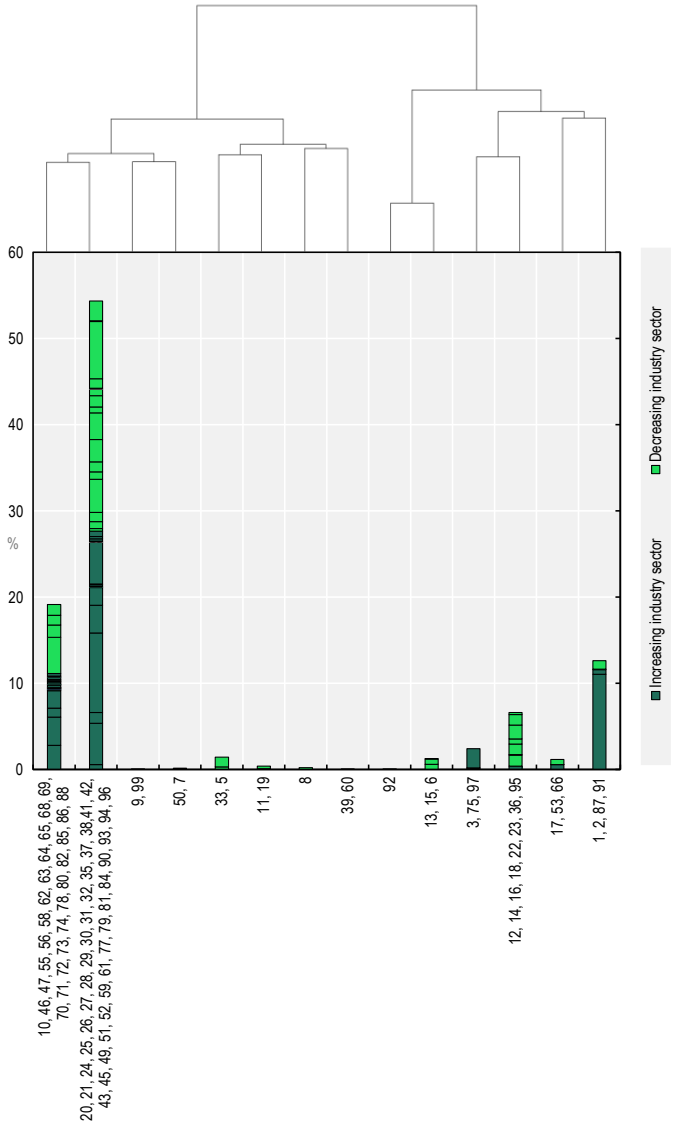
For some blue-collar workers employed in shrinking sectors, transitioning into other blue-collar jobs in growing sectors would entail moving into a sector with relatively high levels of skills similarity (Figure 3.9).[17] For example, blue-collar workers employed in Sector 20 (“manufacture of chemicals and chemical products”) and 21 (“manufacture of basic pharmaceutical products and pharmaceutical preparations”) are projected to decrease between 2019 and 2030 in the Fit for 55 scenario (these sectors are shown in the second cluster from the left in Figure 3.9). However, the skill set demanded of blue-collar workers in these sectors is relatively similar to the skill set demanded in Sector 35 (“electricity, gas, steam and air conditioning supply”), Sector 41 (“construction of buildings”) and 42 (“civil engineering”). These sectors are projected to increase between 2019 and 2030 under the Fit for 55 scenario, employ a relatively large share of blue-collar workers and therefore exemplify relatively viable transition opportunities.

Although Figure 3.9 suggests that some blue-collar workers would have opportunities to transition into sectors with similar skills profiles, for other workers, skills requirements in sectors projected to increase in demand and that account for a large number of the blue-collar workforce differ substantively from the skill set required in their current jobs. For example, the highest degree of similarity in demand of blue-collar workers employed in Sector 5 (“mining of coal and lignite”) is the skill set demanded of blue-collar workers in Sector 33 (“repair and installation of machinery and equipment”) (these sectors are shown in the fifth cluster from the left in Figure 3.9). However, both sectors are projected to decline between 2019 and 2030. There are no other sectors in the same cluster with a skill set that is relatively similar and that is projected to grow, thus providing more viable transition opportunities.

Blue-collar workers are the only category of workers that are projected to experience an absolute contraction in employment opportunities. Figure 3.9 sheds light on the overall share of employment of blue-collar and farm workers in different clusters of sectors with similar skills requirements in 2019 and indicates if employment is projected to increase or decrease between 2019 and 2030. However, it does not indicate the extent to which such an increase/decrease will result in an overall expansion of employment opportunities – a necessary condition of within-cluster transitions – or a net loss or gain of employment.

Figure 3.9. Skills similarity of employment opportunities for blue-collar and farm workers

Dendrogram illustrating sectors based on skills similarity for blue-collar workers, employment shares in 2019 and projected growth/decline between 2019 and 2030 under the implementation of Fit for 55



Note: The top part of the dendrogram illustrates the degree of similarity in the skill set needed in jobs performed by workers in different sectors. Sectors that share the same tree of the dendrogram are closest in terms of skills requirements, as estimated through cosine distance and hierarchical/agglomerative clustering using the Ward variance minimisation algorithm, followed by sectors belonging to the same level one branch, followed by those belonging to the same level two branch, etc. The bottom part identifies the share of blue-collar and farm workers employed in each sector in 2019 (vertical axis, with stacked bar reflecting the size of sectors in increasing NACE [Nomenclature of Economic Activities] code numbering). Each sector bar is colour-coded to reflect if the sector is projected to increase or decline in demand between 2019 and 2030 under the Fit for 55 scenario. Sectors represented in dark green are sectors for which the demand for blue-collar workers is projected to increase between 2019 and 2030, whereas sectors in light grey are sectors for which the demand for blue-collar workers is projected to decrease. Underlying data are available in the Statlink.

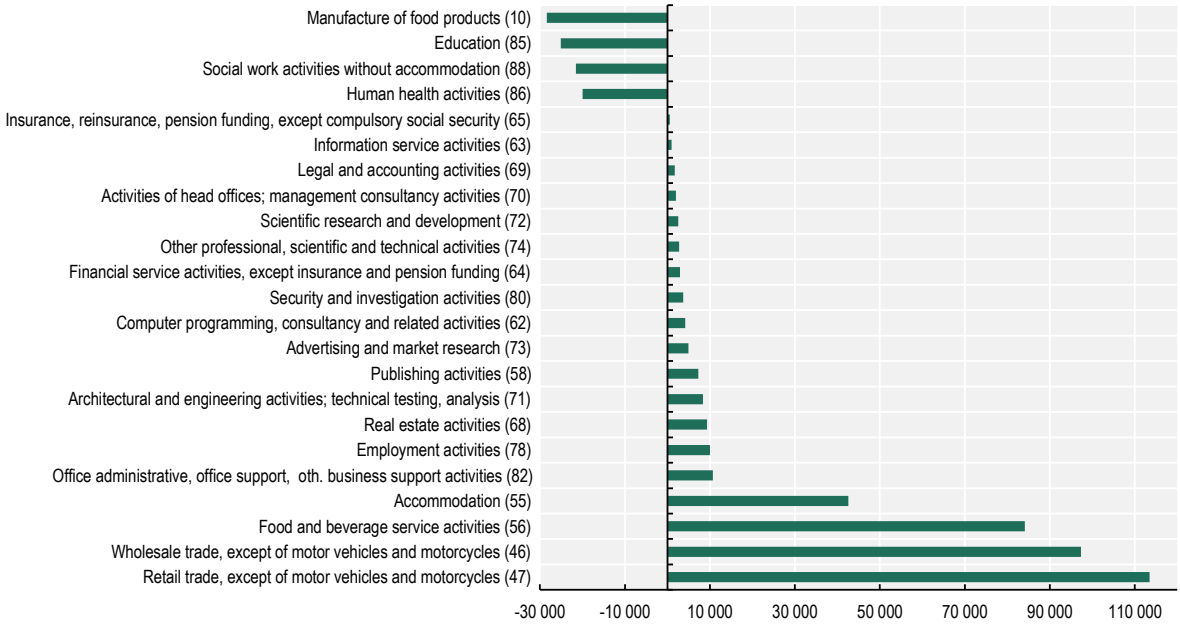
Source: Calculations based on OECD ENV-Linkages model, Lightcast (2023[14]), Lightcast™, https://lightcast.io/, (accessed April 2023), European Union (2019[15]), European Labour Force Survey, ad hoc data extraction (for the year 2019), https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

StatLink https://stat.link/qcuyok

Figure 3.10 illustrates absolute employment losses and gains for each of the sectors in the first cluster (from the left) presented in Figure 3.9, one of the largest clusters in terms of overall employment in 2019 for blue-collar workers. Within this cluster, a positive net employment gain across EU countries of around 315 000 people is projected between 2019 and 2030. This means that for blue-collar and farm workers in this cluster, transition opportunities are available that require a relatively small difference in skills requirements, because projected employment creation in this cluster exceeds projected employment destruction in their original sector.

Figure 3.10. Sectors with several within-cluster transition opportunities

Absolute employment gains and losses by sector



Note: The figure shows the absolute employment gains and losses for the cluster on the left in Figure 3.9, reflecting the difference between total employment gains and total employment losses within the sector. NACE sector numbers are provided behind sector names. Sectors are sorted in descending order from sectors with highest employment gains to sectors with highest employment losses. Borgonovi et al. (2023[2]) provides an overview of NACE sector numbers and sector names.

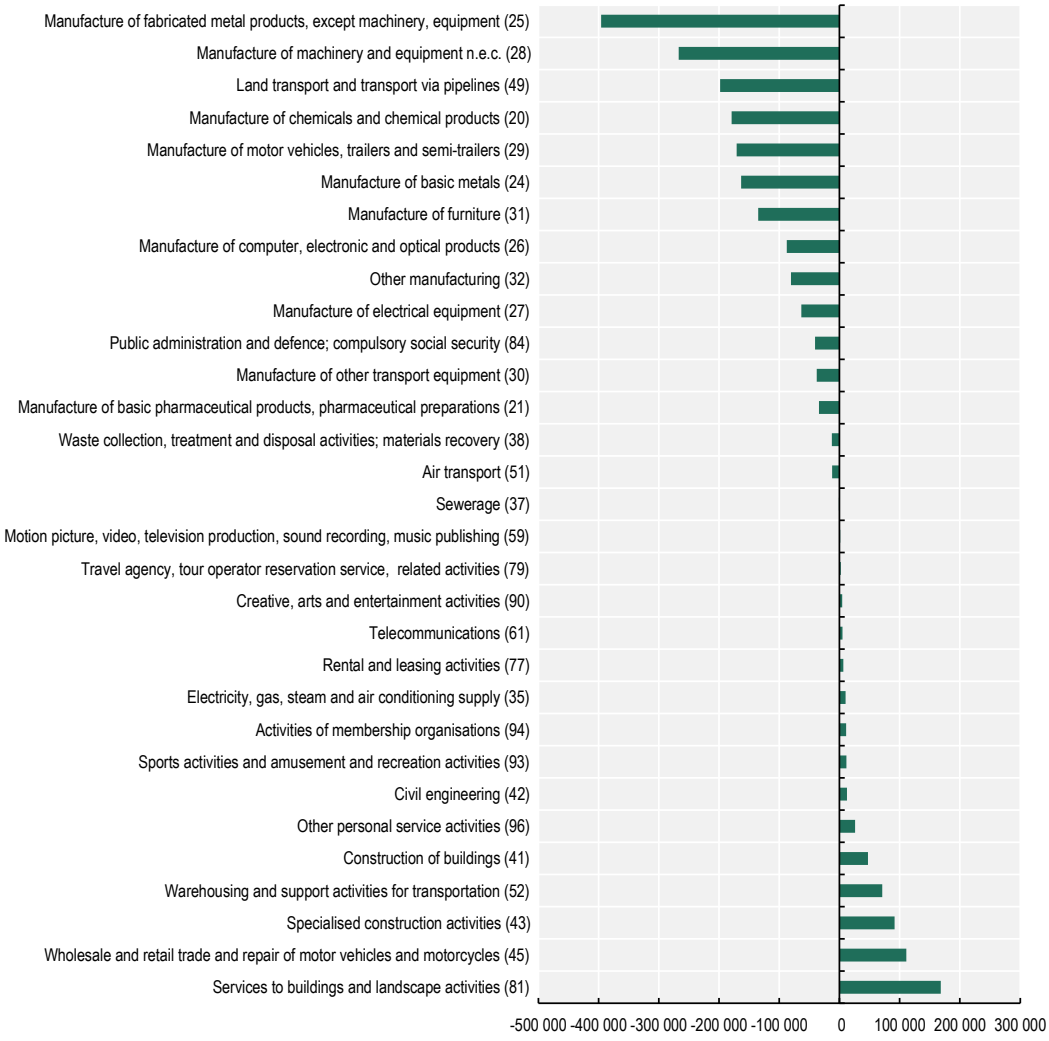
Source: Calculations based on OECD ENV-Linkages model, European Union (2019[15]), European Labour Force Survey, ad hoc data extraction (for the year 2019), https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

StatLink https://stat.link/mxzi70

By contrast, in Figure 3.10, which illustrates absolute employment losses and gains for the second cluster presented in Figure 3.9, total employment gains are smaller than total employment losses. Overall, approximately 1 300 000 jobs are projected to be lost within this cluster between 2019 and 2030. Therefore, blue-collar and farm workers in sectors in this cluster will not enjoy sufficient transition opportunities involving redeployment in jobs with similar skills requirements and will have to consider transitions into sectors with higher dissimilarity in skills requirements in other clusters, a likely indication of longer and more intense training requirements.

Figure 3.11. Sectors with limited within-cluster transition opportunities

Absolute employment gains and losses by sector



Note: The figure shows the absolute employment gains and losses for the second cluster from the left in Figure 3.9, reflecting the difference between total employment gains and total employment losses within the sector. NACE sector numbers are provided behind sector names. Sectors are sorted in descending order from sectors with highest employment gains to sectors with highest employment losses. Borgonovi et al. (2023[2]) provides an overview of NACE sector numbers and sector names The abbreviation '"n.e.c."' in the cluster: "manufacture of machinery and equipment n.e.c," stands for "not elsewhere classified".

Source: Calculations based on OECD ENV-Linkages model, European Union (2019[15]), European Labour Force Survey, ad hoc data extraction (for the year 2019), https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

StatLink https://stat.link/tfdcz8

However, workers in certain sectors that are projected to shrink in employment following the Fit for 55 will also need to transition into new roles. Borgonovi et al. (2023[2]) illustrate opportunities for managers and professionals, technicians and associate professionals, clerical workers and sales and service workers.

3.4. Conclusions

The COVID-19 pandemic gave new impetus to the implementation of climate change mitigation policies worldwide. In particular, in the aftermath of the pandemic, EU governments recognised the short-, medium- and long-term potential threat to public health posed by environmental degradation. Moreover, given the severity of the economic crisis induced by lockdowns, many countries adopted stimulus packages to promote economic growth. In many countries, such investments were tied to achieving reductions in GHG emissions and ambitious structural investments in digital infrastructures. Because past waves of structural transformation led to job losses and long-term vulnerability for some groups of workers, it is crucial to ensure that efforts to promote environmental sustainability will also aim to ensure that the green transition will be a just and inclusive transition, leading to improvements in working conditions and minimising widespread job losses and contractual instability. In order to enhance societal-level resilience and mitigate the risk of environmental disasters resulting from GHG emissions, it is crucial to complement efforts to reduce emissions in production with investments in resilient labour markets. This can be achieved through effective skills policies that facilitate environmentally-driven structural transformations.

Projected changes in employment illustrated in the chapter reflect the specific scenario implemented. However, there is no single pathway towards the green transition and towards meeting the Fit for 55 policy targets. For instance, the EU could rely more on the transition towards a circular economy, scaling up policies such as taxes on primary raw materials, extended producer responsibility, recycled content standards or subsidies for the use of secondary materials as well as R&D towards recycling and better product design for recyclability. A previous modelling analysis shows that the implementation of a material fiscal reform aimed at increasing the relative price of primary materials as compared to secondary materials, would substantially increase the circularity of the economy, while also reducing the environmental impacts of materials use, including greenhouse gas emissions (Bibas, Chateau and Lanzi, 2021[19]). Such a policy package would result in a reallocation of jobs with increases in sectors such as services and waste management and decreases in other sectors such as extraction and mining. Overall, the policy package would result in a small increase in employment (Mavroeidi and Chateau, 2020[20]).

Skills policies, which comprise education and training policies targeted at both young people and adults, can play an essential role in achieving the twin objectives of greening the economy and ensuring that the benefits of new investments do not lead to new forms of vulnerability and deprivation. Skills policies can facilitate the reallocation of workers away from sectors that will shrink because they are responsible for a large share of CO_2 emissions, such as mining of coal and lignite, into sectors that will expand because they can sustain the production of energy without emitting large quantities of CO_2, such as wind and solar energy production or in sectors that will expand because of the new demands induced by the demographic transition (to care for and support rapidly ageing populations) (OECD/ILO, 2022[21]) or the digital transition (to work alongside digital tools and applications performing tasks that will not be automatable) (Lassébie and Quintini, 2022[22]). They are therefore important both because they can facilitate the provision of an adequate supply of workers in sectors that need to develop if CO_2 emission reductions are to be met while maintaining current levels of overall consumption and because they can ensure workers who previously worked in sectors that will decline or disappear will be able to find employment in other parts of the economy. At the same time, skills policies are only part of a broader set of policies that can ensure that the transition is just and inclusive. These include social policies, active labour market policies, and local economic development policies. Achieving green objectives while maintaining strong labour markets and broader social well-being is possible but requires the participation of key actors, including governments as well as social partners.

Results presented in this chapter should be evaluated alongside results from other studies that map how the green transition will change the tasks workers will be required to perform in existing jobs to reduce GHG emissions or in new jobs that will emerge to promote the green transition. In particular, changes in the task content of occupations will change the bundle of skills individual workers and/or teams of workers

will need to possess to successfully carry out their jobs, with important implications for the development and implementation of education and training programmes.

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Notes

[1]. The Fit for 55 package is described in a series of legislations from the European Parliament and the Council (2009[26]; 2009[25]; 2018[27]; 2003[29]; 2008[28]). Following the Fit for 55 package (EU Commission, 2021[24]), EU member states need to reach more ambitious targets than those stated in the Nationally Determined Contributions (NDCs). Furthermore, in June 2022, the Fit for 55 package was revised to include more sectors and more stringent targets for 2030 (European Council and Council of the European Union, 2022[30]).

[2]. Net emissions include emissions and removals from land-use change and forestry (LULUCF).

[3]. A review of this literature is available in Borgonovi et al. (2023[2]).

[4]. In line with information provided in the context of the OECD Skills for Jobs database, the term "skills" is used both as a generic indicator for human capital as well as a term indicating a specific set of proficiencies in manipulating data and things (OECD, 2017[23]). As a generic indicator of human capital, the term skills refers to the broad set of cognitive abilities, physical abilities, socio-emotional abilities and metacognitive abilities (e.g. information-processing skills, dexterity, teamwork, self-organisation) as well as to abilities in performing specific jobs or tasks (e.g. accounting or hair colouring) (OECD, 2017[23]). At the same time, in the context of official classifications of the different sets of skills individuals possess, the term "Skills", capitalised, is used to refer to a particular category of competences.

[5]. A detailed description of the model is available in Borgonovi et al. (2023[2]).

[6]. The cut-off date for the baseline scenario policies derives from IEA's *World Energy Outlook 2021*.

[7] Some jurisdictions enacted climate policies after the publication of the *World Energy Outlook 2021*, such as the Inflation Reduction Act in the United States. These climate policies have not been included in the baseline.

[8] While this analysis focuses on emission reductions, the Fit for 55 package also includes other targets, such as achieving a 40% share of renewable energy in total energy consumption and an emission reduction of 55% for new cars and of 50% for new vans. Furthermore, this analysis applies the targets to CO_2 emissions.

[9] ETS sectors include: fossil-fuel-powered electricity, other energy-intensive industries (e.g. steel, cement, glass, paper), air transport, maritime transport (added in new Fit for 55 package). ESR sectors include: road transport, buildings, agriculture, waste, small industries.

[10] The resulting levels of the carbon prices needed to achieve the targets are provided in Borgonovi et al. (2023[2]).

[11] When interpreting the results, it is important to keep in mind that in a CGE model like ENV-Linkages the labour market is cleared so that labour demand equals labour supply. Therefore, while the policy simulations result in a reallocation of sectoral employment, the labour market will overall remain in equilibrium. In a CGE model, employment can increase or decrease following changes in production. However, the labour market will remain in equilibrium so that it is not possible to evaluate unemployment. While CGE models have the advantage of being able to assess the economy-wide impacts of policies, the fact that they cannot evaluate unemployment is a shortcoming.

[12] The new Fit for 55 package is more ambitious for EU-ETS sectors: -61% between 2005 and 2030 levels, vs -43% for the former target.

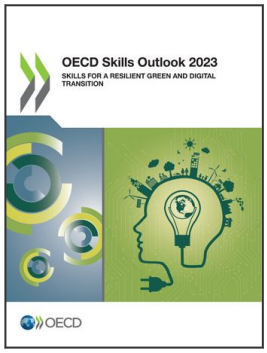
[13] In these sectors, a decrease in emission intensity implies that CO_2 emissions decrease more than production.

[14] A detailed description of the methodology is available in Borgonovi et al. (2023[2]).

[15] A detailed description of the different skills categories is available in Borgonovi et al. (2023[2]).

[16] A final consideration pertains to wages.

[17] A detailed description of the methodology used to develop skills similarity is available in Borgonovi et al. (2023[2]).



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