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G7 GERMANY



► Skills for Decarbonisation

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▶ 1. Introduction

1.1 Global policy context

Decarbonisation of the economy is having a profound impact on the labour market and skills composition of the workforce. Yet, decarbonisation is not an isolated trend but is occurring in conjunction with other global megatrends such as demographic shifts and technological change and digitalisation. These different megatrends form a complex web of dynamic and intertwined factors that are reshaping the world of work.

The pace of population ageing in the G7 countries has direct or indirect effects on climate change and the decarbonisation policies as well as by driving changes in the consumption level and structure and limiting the fiscal space (EEA 2019). To cope with slowdown in labour force growth and expected labour shortages, targeted employment activation measures are required to be taken for older workers along with training to keep their skills up to date, particularly in the context of rapid technological advancements and decarbonisation (OECD 2019).

Digitalisation is penetrating many jobs across economic sectors, including those that support decarbonisation notably with the development and application of green technologies for green goods production and service delivery. At the same time, it is creating demand for new skills, altering the demand for specific tasks and skills and leading to job losses, in particular jobs involving routine and manual tasks. Though the overall employment effects from digitalisation is expected to be positive in a long run (OECD 2019) some immediate technology-induced job losses may be partially compensated by decarbonisation measures, altogether contributing to the process which is often called the creative destruction of jobs.

Decarbonisation accelerates and contributes to this process. The green transition creates new jobs, causes some job losses and change the skills composition of many jobs. In addition, the COVID-19 pandemic has accelerated many preceding trends and introduced new disruptions, providing an opportunity and the need for a human-centred recovery that is inclusive, sustainable and resilient (ILO, 2021, OECD 2021a and 2022a, forthcoming). The ongoing war in Ukraine resulted in a massive outflow of refugees to Europe, raising energy and food prices, disrupting international trade, labour markets, the economic and employment recovery (ILO, 2022a, forthcoming; OECD 2022b). The acute need for job creation and related reskilling and upskilling are thus further amplified, including through decarbonisation measures and the green job opportunities.

This discussion paper considers the implications of decarbonisation for labour markets and the demand for skills in the G7 and EU countries and provides policy recommendations to address different skills challenges.

1.2 Why skills matter for a just transition to environmental sustainability

Realizing the job creation potential of decarbonisation and ensuring that the transition is just will not be possible without ensuring that current workers and potential labour market entrants have relevant skills. A good mix of foundational, technical and core skills for the green transition helps to mitigate the risks of job loss as well as prevents skills and labour shortages for the newly created jobs. Upskilling and reskilling measures along with career guidance and other support services are needed to help workers move from one occupation to another or adapt to new tasks. Promoting learning throughout working careers is therefore vital to improve the transferability of workers across occupations and sectors and buffer against the negative consequences of disruptions arising in the transition to the decarbonised economy.

1.3 NDCs and skills development

The country commitments to the Paris Agreement, or Nationally Determined Contributions (NDCs), propose adaptation and mitigation measures in targeted economic sectors. By implementing these commitments, countries will be able to transition to an environmentally sustainable and low-carbon economy. Yet, to translate into reality the far-reaching goals that governments have put forward in their climate change commitments in the energy, agriculture, waste, manufacturing, transport, construction and tourism sectors, relevant capacity building and skills training will need to be implemented to equip the workforce with relevant skills in these industries.

A quick glance at the latest submissions of NDCs by G7 countries and the European Union shows that only Canada makes a clear reference to skills interventions and education and training provisions as part of their national commitments to climate action. This signals to countries to revisit the key climate and environmental policies and regulations, including NDCs. Effectively designed NDCs need to go beyond climate change literacy and have to integrate continuing vocational training and active labour market policies at national and sectoral levels.

► 2. The employment effects of greening the economy

2.1 The energy sustainability and circular economy scenarios

The green transition is the process by which economies reduce their reliance on greenhouse gas (GHG) emissions and become resource efficient which “results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities” (UNEP 2011). The ILO research shows that a low-carbon and resource-efficient economy could employ more people than by the business-as-usual scenario and is at least as productive as a carbon- and resource-intensive economy. In this context, expanding on the ILO’s exploration of the likely employment effects by 2030 of reaching the goal of the Paris Agreement on Climate Change, the implications of the green transition for skills, gender and occupations for the G7 and EU countries were analyzed based on the energy sustainability and circular economy scenarios.

The energy sustainability scenario implements the energy pathways for each country and industry up to 2030, laid out by the International Energy Agency (IEA, 2017) for the policy goal of limiting global warming to 2°C (the 2°C scenario). This scenario considers substitution of fossil fuel-based energy by renewables and improvements in energy efficiency, taking into account the changes in electricity and heat generation, industry energy demand, transport, and construction. Inherent in this scenario is the projected rise in the share of electric vehicles in the transport sector and building improvements to achieve greater energy efficiency in the construction sector. The 2°C scenario is compared with a business-as-usual scenario, as defined by the IEA 6°C scenario by 2030.

The circular economy scenario considers the shift away from current models typified as linear: extract, manufacture, use and discard to the principle of produce-use-service-reuse. It explores the employment impact of a sustained 5 per cent annual increase in recycling rates for plastics, glass, pulp, metals and minerals across countries, replacing the direct extraction of the primary resources for these products. This scenario also models growth in the service economy which, through rental and repair services, reduces the ownership and replacement of goods. The scenario considers a 1 per cent annual growth in the services sector, replacing the corresponding demand for the ownership and replacement of goods. It is also compared with the business-as-usual scenario (the IEA 6°C scenario).

Both scenarios draw on projections of GDP growth made by the International Monetary Fund (IMF) and the International Energy Agency (IEA) and population growth projections by the United Nations as well as other supplementary data sources.

2.2 Projections in the energy sustainability and circular economy scenarios

The ILO has produced global scenarios of the impact of the transitions to energy sustainability and circular economy on employment by 2030 (ILO, 2019a)¹. The data for the G7 and EU economies combined shows that under the energy sustainability scenario, close to 5.1 million jobs could be created and slightly over 1.1 million jobs could be destroyed². Of those workers whose jobs may be destroyed, over 90% of workers will be able to reallocate in their countries within same occupations in growing industries. Under the circular economy scenario, nearly 11.5 million

¹ This analysis was conducted using a multi-regional input–output model (EXIOBASE v3) to analyse transactions between 163 industries across 44 countries to quantify the occupational skills needs of the transition to energy sustainability and to a circular economy. By weighting the results to reflect employment composition in other countries, global scenarios were produced. Expanding on the ILO’s exploration of the likely job impacts by 2030 of keeping the rise in global temperature below the 2°C ceiling set by the Paris Agreement on Climate Change (ILO, 2018), this study analysed the implications of the transition to low-carbon and resource-efficient economies for skills, gender and occupations.

² For the methodological details see Annex 1. The ILO scenarios are used for the implications on employment by sector and occupation, skill level and gender in G7 and EU countries for analysis in this paper. As with all modelling and projection exercises, these scenarios are subject to uncertainty and should be taken as indicative of general trends rather than as precise estimates.

jobs could be created and slightly more than 3.8 million may be destroyed but over 80% of people at risk of losing jobs will be able to find jobs in their countries and within the same occupations in growing industries. This means that under both scenarios most of workers may relocate using the set of skills they have, ultimately, with some short training relevant for the new industry. Around 10 to 20% of workers will require reskilling into new occupations.

In both the energy sustainability and the circular economy scenario, job creation is expected to outpace job destruction in the G7 and EU countries. This is well aligned with the global trend of the ILO report on skills for a greener future (ILO, 2019a) and other global and regional estimates based on different scenario assumptions. The recent findings of Cedefop based on the European Green Deal (EGD) skills forecast scenario suggest that employment growth with the implementation of policies supporting EGD goals is higher than without it (Cedefop, 2021). 1.2% additional employment growth in 2030 is expected in the EGD scenario which translates into around 2.5 million additional jobs in the EU (ibid). Although employment decline in certain sectors such as mining and quarrying is expected, implementing the EGD brings net job gains in the EU (ibid).

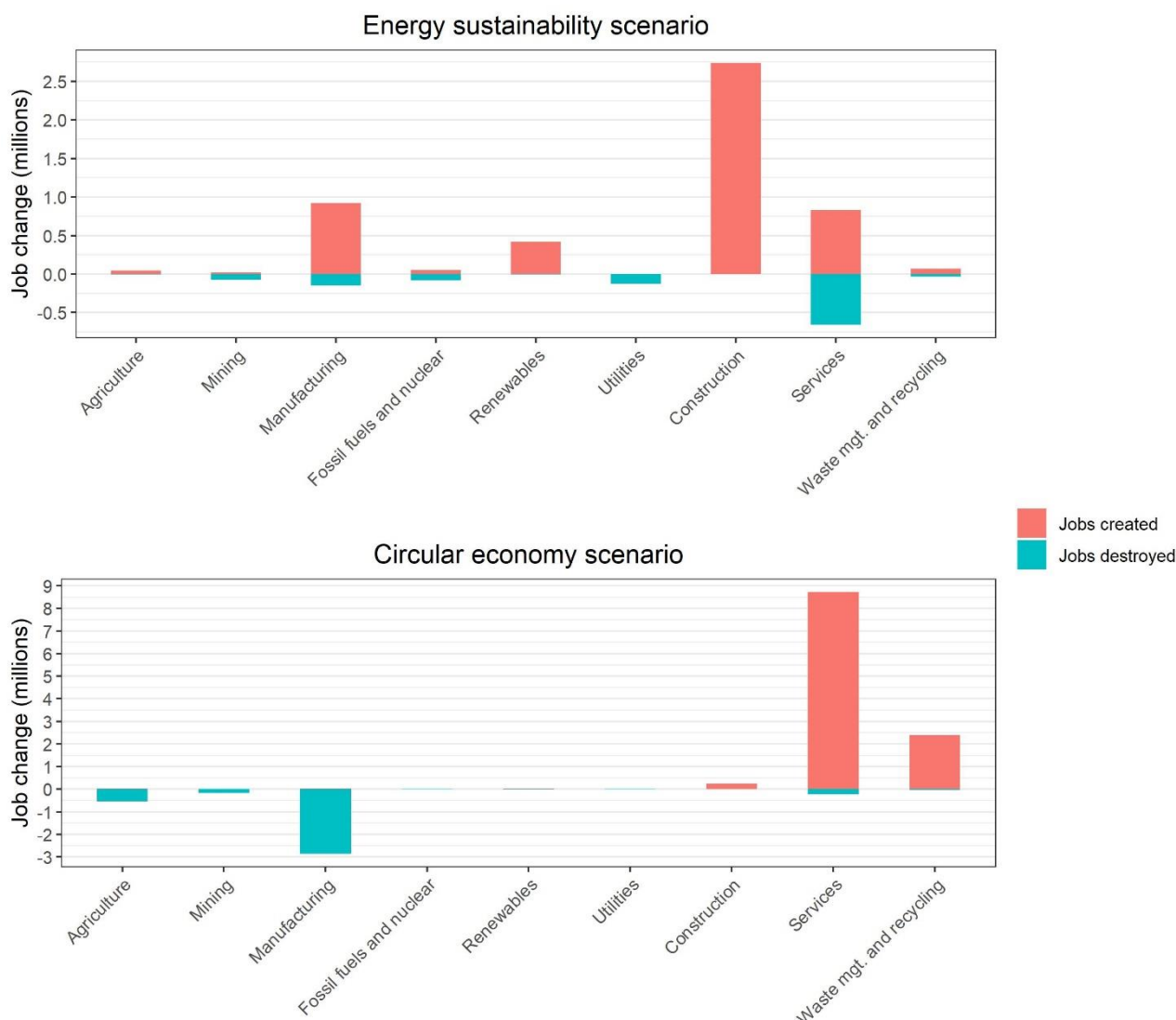
In the context of the COVID-19 green recovery fiscal and other policy measures, the latest assessment of the ILO and the Partnership for Action on Green Economy (PAGE) demonstrated that investments into renewable energies, building efficiency, green transport and ecosystem restoration and reforestation projects would create a net gain of additional 20.5 million jobs globally by 2030 (PAGE 2021). The OECD has also carried out modelling of the employment and wage distribution consequences of decarbonisation policies (Chateau et al. 2018). It finds that, like the ILO results, there is a small overall net employment gain, although with some differences in the modelled size of job losses and job gains.

2.3 Sectoral trends in two scenarios

The impact of the green transition in the ILO scenarios varies across industries in the G7 and EU countries (see figure 1). Broad industries set to experience the highest net job change under the energy sustainability are construction, manufacturing (e.g. electrical equipment, fabricated metal products), renewables (e.g. wind, biomass and waste, solar thermal) and services sectors (e.g. wholesale and retail trade) among others. Job destruction is concentrated in sectors related to fossil fuel energy generation, and production and services in this and other polluting sectors, including nuclear energy. Therefore, the clean energy transition requires policy measures for workers in the declining sectors to ensure that no workers are left behind this transition.

The circular economy transition scenario is expected to benefit services (e.g. retail and wholesale trade, repair of household goods, research and development), waste management and recycling (e.g. re-processing of secondary materials), and construction among others. Net job creation is the highest in services possibly owing to increasing importance on repair and rental services gains over the replacement and ownership of goods. It is also led by the re-processing of materials (e.g. steel, wood, zinc, copper, aluminium) to be used as inputs in industries that would have otherwise drawn these materials from value chains associated with the extraction of natural resources. Job destruction is concentrated in manufacturing sectors, particularly in value chains associated with the processing of raw materials, as they may be replaced by recycled materials which require no extraction and make fewer demands on fossil fuel energy.

► **Figure 1. Jobs created and destroyed in energy sustainability and circular economy scenarios by broad industries, to 2030 (G7 and EU countries)**



Notes: Difference in employment between the respective scenario and the IEA 6°C (business-as-usual) scenario by 2030. Vertical scales differ by panel.

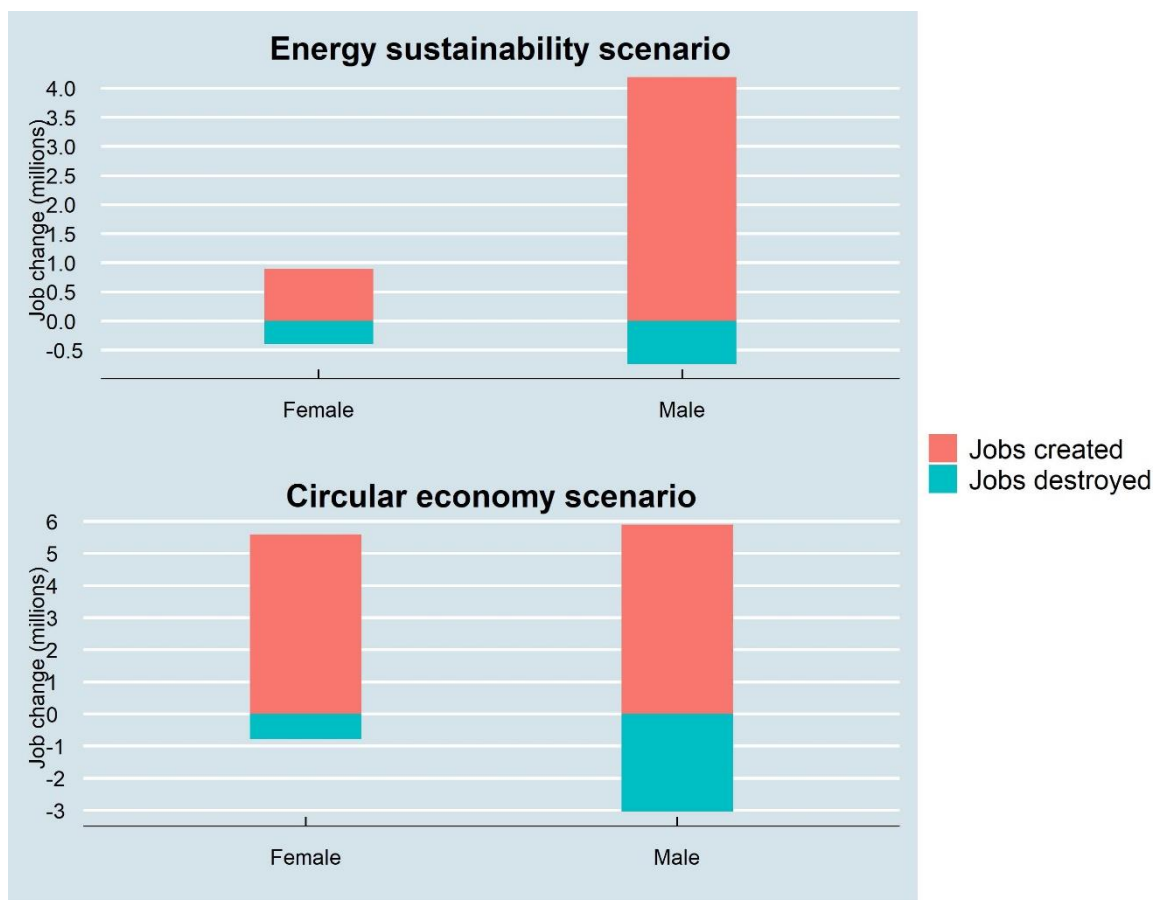
Source: ILO calculations based on EXIOBASE v3.

2.4 Gender outlook in two scenarios

The gender effect is more noticeable in the energy sustainability scenario (see figure 2). This may be attributed to the fact that industries benefiting from the energy transition such as construction, manufacturing and electricity production are currently more male dominated. In the circular economy scenario, the number of jobs created for both males and females are roughly comparable as industries driving the job creation employ relatively more female workers such as in services industry (e.g human health and other personal service activities). The same gender effects hold for the declining sectors such as mining (figure 2).

Overall, in both the energy sustainability and the circular economy scenario³, most job creation and destruction could be concentrated in occupations currently occupied by men in G7 and EU countries. This suggests that current occupational gender patterns are likely to persist in 2030 and net-employment opportunities might be created more for men than women in the green transition unless targeted measures are taken to break prevailing gender employment stereotypes and inequalities.

► **Figure 2. Jobs created and destroyed in energy sustainability and circular economy scenarios by gender, to 2030 (G7 and EU countries)**



Note: For methodological details, see Annex 1. Vertical scales differ by panel.

Source: ILO calculations based on EXIOBASE v3 and national labour force surveys

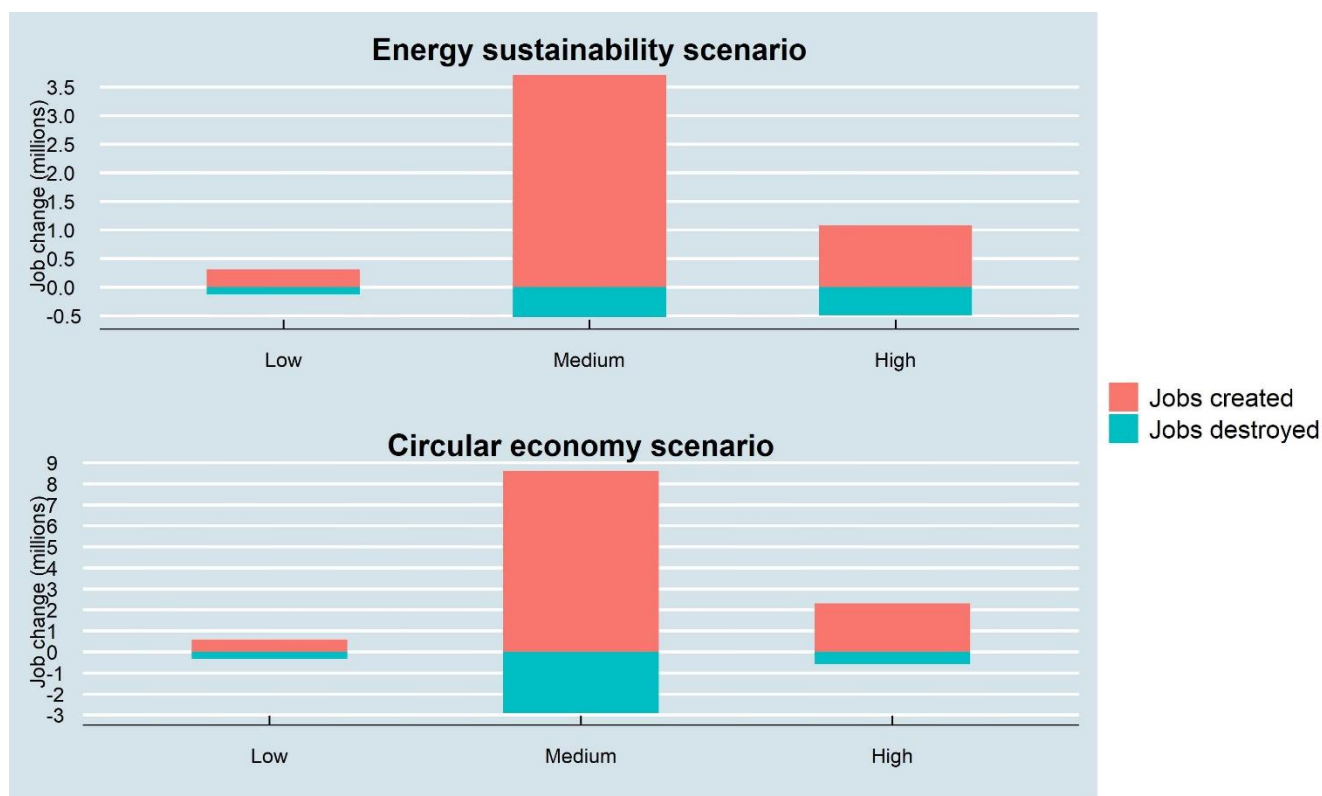
The danger is that business as usual may add to the occupational gender gaps in digitised jobs, especially requiring advanced digital skills, where women are also underrepresented (ILO, 2021). Usually, gender gaps in education and training programmes related to green and digital jobs translate into gender gaps in related occupations. Therefore, policy measures should target promoting gender equality in participation in training, especially in STEM and digital skills in the upper-secondary and post-secondary technical and vocational education and training (TVET) and in university education.

³ The projections assume that underlying trends – except for those explicitly modelled – remain the same. This applies to the industrial and trade structure of countries and to the gender distribution of workers across occupations.

2.5 Job changes in two scenarios by skills level

Of the nearly 5.1 million and 11.5 million jobs created under the energy sustainability and circular economy scenario respectively, more than 90% of jobs created are in medium to high skilled occupations. These results suggest that the increase in demand for mid-skill occupations in the green transition may partly offset the global trend in which skill-biased technological change is hollowing out mid-skill occupations. The results highlight the importance of TVET in facilitating the transition to low-carbon and resource-efficient economies and societies by providing technical middle-level skills training for new entrants and exploiting the reskilling/upskilling potential for workers in medium-skilled occupations. It is also important to note that although the net-employment effect of greening is smaller in higher-skilled occupations, these occupations play a key role in developing green technologies and driving green innovation which is indispensable for the green transition.

► **Figure 3. Jobs created and destroyed in energy sustainability scenario by skill level, to 2030 (G7 and EU countries)**



Note: Occupations measured at the two-digit level and aggregated to one-digit level so that occupations requiring high-level skills are listed under the International Standard Classification of Occupations (ISCO-08) codes 1, 2 and 3; those requiring medium-level skills are listed under ISCO-08 codes 4, 5, 6, 7 and 8; and those requiring low-level skills are listed under ISCO-08 code 9. For methodological details, see Annex 1. Vertical scales differ by panel.

Source: ILO calculations based on EXIOBASE v3 and national labour force surveys.

▶ 3. Occupational and skills effects of the green transition

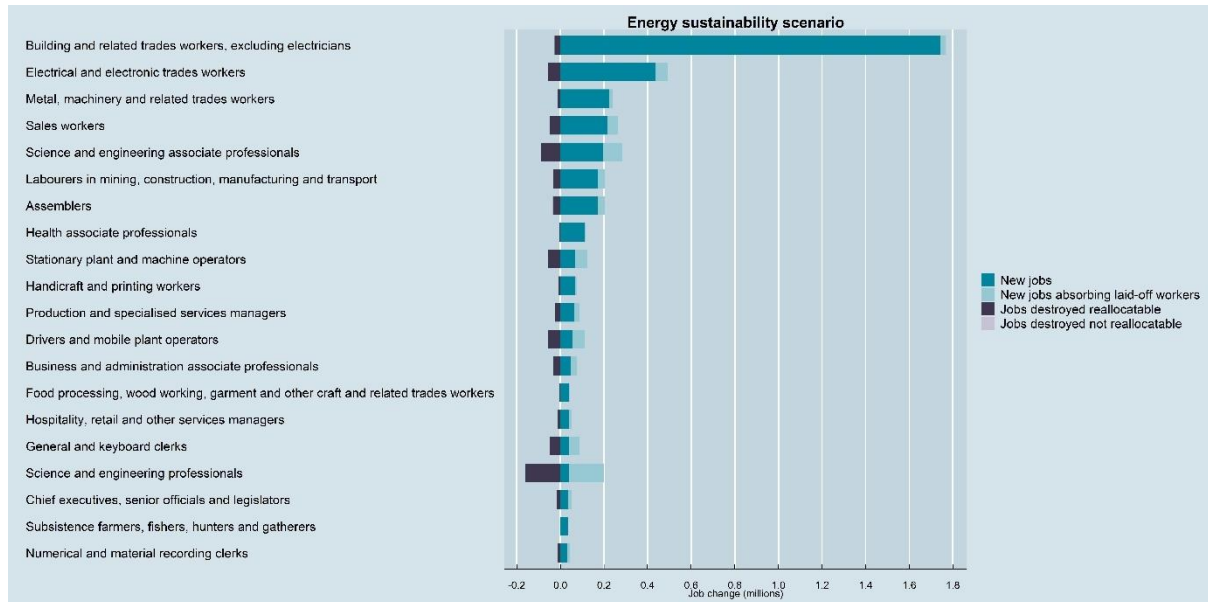
3.1 Occupational change and transitional paths in the green transition

Some occupations will experience high levels of job creation with little or no job destruction, requiring a policy focus on securing workforce pipeline through TVET, university education and skills development. Other occupations will experience high levels of both job creation and job destruction, requiring a policy focus on reskilling and/or upskilling, to support the reallocation and transition of workers within the same group of occupations within countries across industries. The ILO identified 20 occupations which will experience the highest levels of net-job creation and those which will experience the highest levels of reallocation in G7 and the EU countries under the energy sustainability and circular economy scenario respectively (see figure 4 and 5).

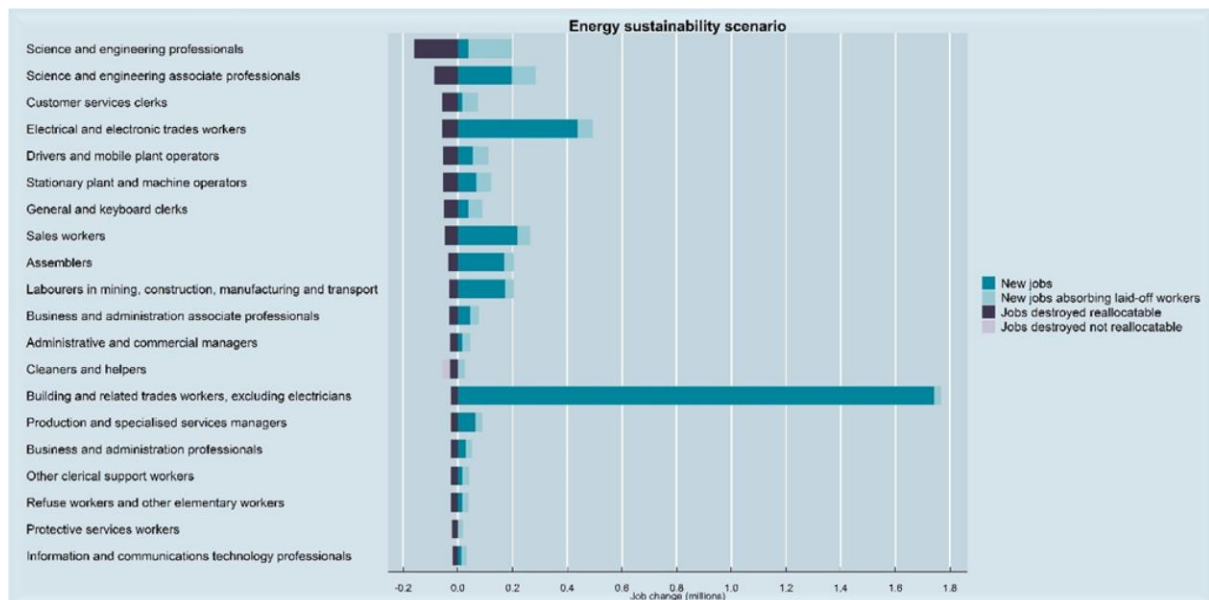
Under the energy sustainability scenario, the occupations that will experience the highest level of net-job creation, requiring the skilling of new and existing workers, include building and related trades workers, electrical and electronic workers, metal and machinery workers, sales workers and science and engineering associate professionals (see Panel A). The higher-than-average demand for building and related trades workers can be explained by increased consumer awareness and market demand for zero-net-energy and -emissions buildings either through retro-fitting the existing built environment or new construction. Occupations experiencing the highest reallocation within the group of occupations in other industries include science and engineering professionals, science and engineering associate professionals, customer services clerks and electrical and electronic trades workers (see Panel B). For example, science and engineering professionals can move from industries related to fossil fuel-based resource production to those related to the renewable energy sectors.

► **Figure 4. Jobs created and destroyed in an energy transition scenario by occupation, to 2030**

Panel A. Occupations with the highest number of new net jobs created in a low-carbon energy scenario



Panel B. Occupations with the highest reallocation of jobs across industries in a low-carbon energy scenario



Notes: Occupations measured at the ISCO-08 two-digit level. Panel A shows the 20 occupations with the highest level of new jobs. Panel B shows the 20 occupations with the highest level of new jobs absorbing laid-off workers. “New jobs absorbing laid-off workers” are jobs that can be filled by similar (reallocatable) jobs lost in other industries in the same country or region (“Jobs destroyed reallocatable”). “New jobs” are jobs created that cannot be filled by jobs lost in similar occupations from other industries in the same country or region. “Jobs destroyed not reallocatable” are jobs for which vacancies in the same occupations in other industries within the same country or region will not be found. See Annex 1 for methodological details.

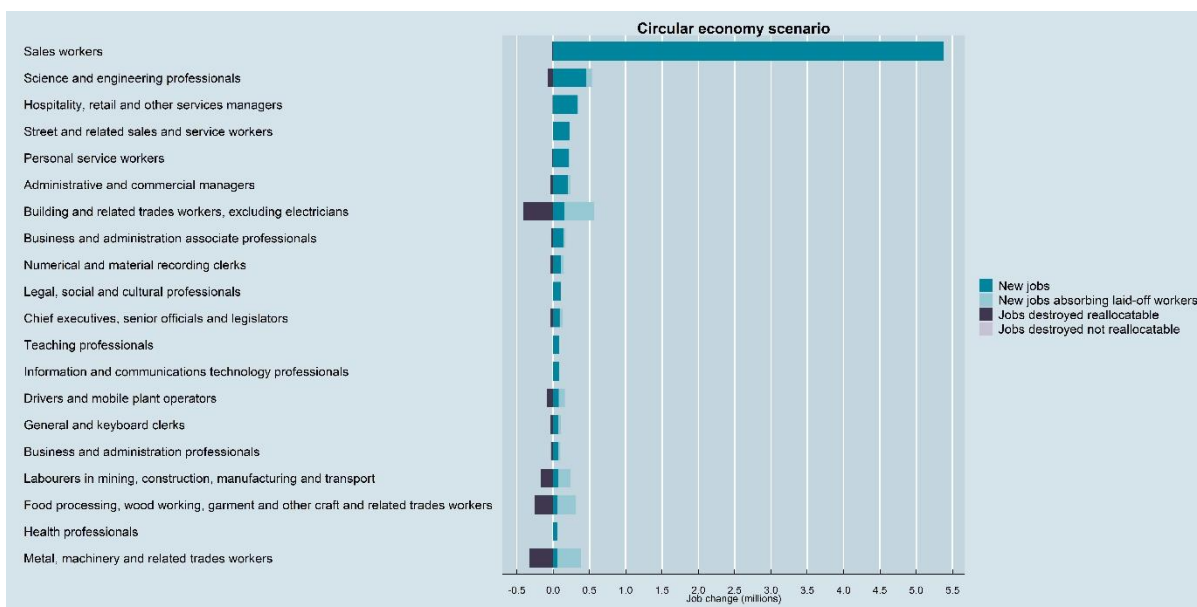
Source: ILO calculations based on EXIOBASE v3 and national labour force surveys

In the circular economy transition scenario, occupations such as sales workers are expected to benefit the most. This may be a result of the growth in household consumption (induced effects) and the consequent growth in the

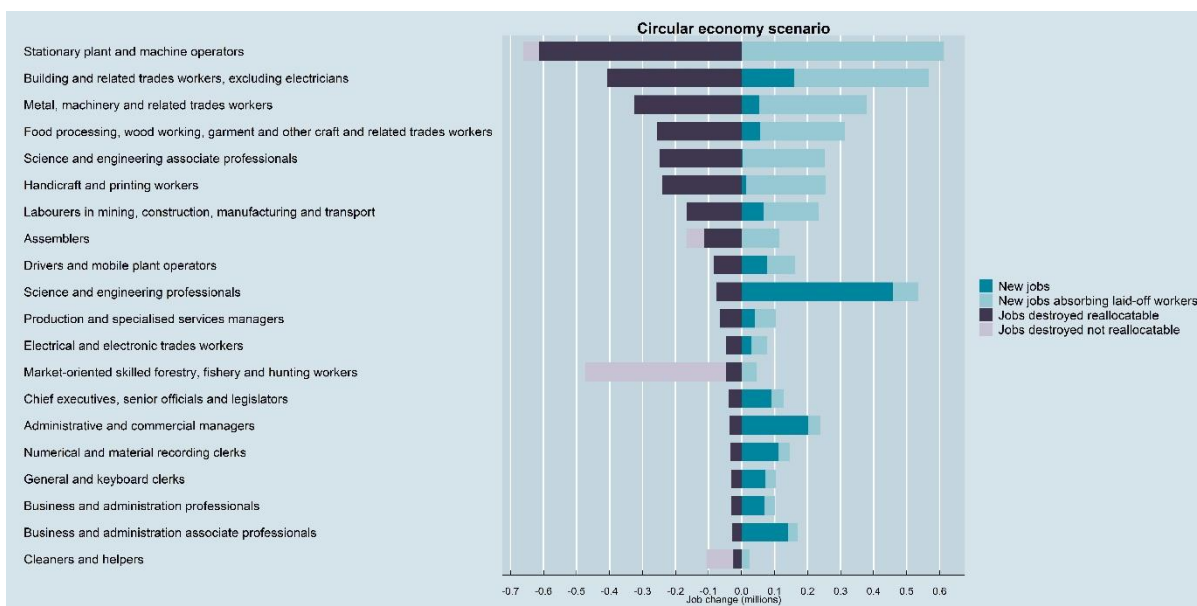
retail trade sector (see Panel A). High net-job creation is also observed in occupations such as science and engineering professionals, hospitality, retail and other services managers, personal service workers, administrative and commercial managers. Occupations with the highest reallocation of jobs across industries are stationary plant and machine operators, building and related workers, metal and machinery workers (see Panel B). For instance, workers in the metal, machinery and related trades, and stationary plant and machine operators can move from industries related to the extraction of materials and manufacturing of goods to those related to the repurposing of materials and the repair of goods.

► **Figure 5. Jobs created and destroyed in a circular economy scenario by occupation, to 2030**

Panel A. Occupations with the highest number of new net jobs created in a circular economy scenario



Panel B. Occupations with the highest reallocation of jobs across industries in a circular economy scenario



Notes: Occupations measured at the ISCO-08 two-digit level. Panel A shows the 20 occupations with the highest level of new jobs. Panel B shows the 20 occupations with the highest level of new jobs absorbing laid-off workers. “New jobs absorbing laid-off workers” are jobs that can be filled by similar (reallocatable) jobs lost in other industries in the same country or region (“Jobs destroyed reallocatable”). “New jobs” are jobs created that cannot be

filled by jobs lost in similar occupations from other industries in the same country or region. “Jobs destroyed not reallocatable” are jobs for which vacancies in the same occupations in other industries within the same country or region will not be found. See Annex 1 for methodological details.

Source: ILO calculations based on EXIOBASE v3 and national labour force surveys.

These results show that there will be a net creation of jobs above and beyond the jobs that can be filled by reallocation. This particularly concerns building and related trade workers and electrical and electronic workers under the energy sustainability scenarios, and sales workers under the circular economy scenario and more. To prevent potential skill shortages, the development of the corresponding skills in formal training to support the pipeline of future workers, and potentially also designing relevant migration policy, will be needed. In addition, this provides an important ground to design training programmes to reskill laid-off workers who may not find jobs within their former occupations for smooth entry into newly growing occupations. Although a large majority of occupations affected by the green transition could be reallocated in G7 and EU countries, there are jobs at risk of destruction that may not be reallocated to the same or similar occupation in another industry, posing a potential risk of unemployment. Such programmes could be delivered through ALMPs and should be accompanied with relevant career guidance and social protection measures.

3.2 Types of skills in demand in the green transition

The ILO’s real-time big data analysis using BGT US data set for 2017 as a proxy allowed to take a closer look at specific skills related to the green transition. The analysis showed that there could be three core types of skills that workers can re-use in new jobs in the same groups of occupations in growing industries. Such employability skills will include core and basic skills (e.g. communication, problem solving, literacy, including digital and climate literacy, numeracy), semi-technical transferable skills (e.g. sales and marketing, customer handling) and technical transferable skills (e.g. engineering, repair). Yet, there are also some technical skills specific to occupations which tend to be technology and industry sensitive.

It should be noted that some core skills are needed by all workers, regardless of the general skill level of their occupation; medium- to high-skilled occupations may particularly require additional skills of this kind (see table 1). This is an important finding with significant implications for the update and design of competency standards and curricula in TVET and tertiary education.

► **Table 1. Main core (soft) skills required for green transition, across occupations and for medium-to-high-skilled occupations**

Required across the labour force	Required in medium to high-skilled occupations
<ul style="list-style-type: none"> • Environmental awareness and respect; willingness and capability to learn about sustainable development; • Adaptability and transferability skills, to enable workers to learn and apply the new technologies and processes required to green their jobs; • Teamwork skills, reflecting the need for organizations to work collectively on tackling their environmental footprint; • Resilience, to see through the changes required; 	<ul style="list-style-type: none"> • Analytical thinking (including risk and systems analysis) to interpret and understand the need for change and the measures required; • Coordination, management and business skills that can encompass holistic and interdisciplinary approaches incorporating economic, social and ecological objectives; • Innovation skills, to identify opportunities and create new strategies to respond to green challenges; • Marketing skills, to promote greener products and services;

<ul style="list-style-type: none">• Communication and negotiation skills, to promote required change to colleagues and customers;• Entrepreneurial skills, to seize the opportunities of low-carbon technologies and environmental mitigation and adaptation;• Occupational safety and health (OSH).	<ul style="list-style-type: none">• Advocacy skills, to advise consumers about green solutions and to spread the use of green technologies;• Networking, ICT and language skills, to perform in global markets;• Strategic and leadership skills, to enable policy-makers and business executives to set the right incentives and create conditions conducive to cleaner production and services.
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Source: ILO, 2019a, Skills for a greener future: A global view

► 4. Will the dual impact of the Ukraine war and COVID-19 pandemic boost or disrupt the green transition?

The COVID-19 pandemic had a negative impact on employment, especially for young people, women, older workers and the low-skilled (ILO, 2021d). Recovery fiscal stimuli measures, widely introduced by countries, have a potential to boost jobs and contribute to environmental sustainability (PAGE, 2021, LinkedIn, 2022). In light of this, a global narrative for green recovery has emerged, many countries have committed to include green measures in their fiscal stimulus packages and some governments have already done so, with a view to building forward better from the crisis (OECD 2021b).

However, the global prospect of a green recovery is highly uncertain, with the current war in Ukraine and lingering effects of the pandemic. The IMF announced the downward revision of its projection for global growth to 3.6% in both 2022 and 2023 (including downward revision for all G7 and EU countries), underlining serious challenges posed by the Russian invasion in Ukraine across the globe through commodity markets, international trade, global supply chains and financial linkages (IMF, 2022a).

In addition, fiscal policy space is rather limited in many countries to buffer the economic impact of the war, as much fiscal measures were already used as a response to the pandemic which constraints the implementation of green fiscal policy. What is more, high level of inflation is expected to linger, and in some economies where the labour market tightness is observed, reflecting the reduced labour pool of available job seekers and making it harder to fill vacancies, this would further intensify inflation pressures. Particularly, low-skilled workers accounted for more than two-thirds of the aggregate employment gap vis-à-vis its pre-COVID-19 trend by late 2021, where disrupted labour migration contributed to the situation; older workers—including low-skilled ones—contributed about one-third of the employment gap (IMF, 2022b).

The wave of over 5 million refugees from Ukraine, who are normally granted work permits, certainly represent a challenge to be turned into an opportunity. Some may be ready to take low-skilled jobs due to lack of language skills, contributing to resolving some of the labour market tightness. Two-thirds of them however are highly qualified and nearly half were employed in high-skilled occupations before the war (ILO, 2022a, forthcoming), and may potentially contribute to productive transformation including decarbonisation and digitalisation. Continuing to combine fiscal stimuli along with ALMPs, matching and career guidance supported by PES would be important for activation and reskilling of both national and migrant workers for filling the jobs available, including the jobs created by the green stimuli measures.

The Ukraine crisis caused the sharp rise of fuel prices and disclosed the fragility of the current global energy systems. There is a strong determination of countries, particularly in the EU, to diversify energy sources including with renewables. While this could hasten the energy transition, implementing such plans are dependent on the availability of skilled workers in the labour market.

► 5. Policy recommendations

5.1 Investing in reskilling and upskilling of the workers for the green transition is essential for a just and green recovery from COVID-19

The ILO's *Guidelines for a just transition towards environmentally sustainable economies and societies for all* and the OECD's policy approach for a *human-centred green transition* highlight the importance of inclusive skills development policies (see box 1). Skills development measures are an important pillar and enabler of industrial, investment and other productive transformation policies for a just transition. The availability of the right skills paves the way for the transition to carbon-neutral, environmentally sustainable and socially inclusive economies. It is therefore crucial to identify needed skills and direct substantial investment towards upskilling and reskilling of workers, thus enhancing ability to tap into new green jobs opportunities and improving mobility across occupations and sectors. With effective reskilling and upskilling measures, the transition costs of workers can be minimized, and the employment potential can be maximised, but these positive outcomes depend on the policy design that combines training with other active labour market programmes (ALMPs), social protection, career counselling services as well as fiscal and industrial policies.

► **Box 1. An integrated policy approach to promoting the green transition**

ILO Guidelines for a just transition towards environmentally sustainable economies and societies for all

In 2015, the ILO adopted the Guidelines for a just transition towards environmentally sustainable economies and societies for all aimed at enabling governments, workers and employers around the globe to leverage the process of structural change towards a greener, carbon-neutral economy, create decent jobs at a large-scale and promote social protection. These Guidelines are both a policy framework and a practical tool to help countries at all levels of development manage the transition to low-carbon economies and can also help them achieve their Nationally Determined Contributions (NDC) and the 2030 Sustainable Development Goals.

Key policy areas to address environmental, economic and social sustainability simultaneously include:

- ▶ Macroeconomic and growth policies
- ▶ Industrial and sectoral policies
- ▶ Enterprise policies
- ▶ Skills development
- ▶ Occupational safety and health
- ▶ Social protection
- ▶ Active labour market policies
- ▶ Rights
- ▶ Social dialogue and tripartism

OECD policy approach for a human-centred green transition

The OECD's policy approach for a human-centred green transition is structured around four pillars:

Mitigate the possible regressive impact of pricing environmental externalities for vulnerable households.

Achieve inclusive green growth with investment in human capital, through active labour market policies, well-targeted income support measures, and upgrading skills to facilitate labour reallocation.

Address systemic inequalities with sectoral and place-based policies that facilitate social dialogue, social capital investments, social protection, skills and education investments to ease structural adjustment of local economies.

Ensure efficient and responsive governance to manage the inclusive green transition.

Source: ILO (2016), Guidelines for a just transition towards environmentally sustainable economies and societies for all; and OECD (2021c), The Inequality-Environment Nexus: Towards a People-Centred Green Transition, *OECD Green Growth Papers*, 2021-01, OECD Publishing, Paris. <https://doi.org/10.1787/ca9d8479-en>.

Skills development and training for green jobs should be an integral part of fiscal stimulus and recovery measures, along with support for enterprises and workers in sectors negatively impacted by the green transition, geopolitical instability and lasting health crisis (see example in Box 2).

► **Box 2. Scotland example on reskilling and upskilling measures in the context of COVID-19 and green recovery**

Scotland provides a good example of refocusing investment for a just transition that the country launched a GBP 25 million National Transition Training Fund to train people who have either lost their job or are at risk of redundancy as a result of COVID-19, while supporting them to tap into jobs available in growing sectors which contribute to country's net-zero transition in 2020. In addition, the North-East Economic Recovery and Skills Fund (NEERSF) was put in place between 2021 and 2022 to help alleviate the dual impacts of the pandemic and the downturn in oil and gas sector in the North-East of Scotland through helping oil and gas workers to move into roles in the low carbon energy sector.

Source: Scottish Funding Council 2020; Scottish Government 2022

5.2 Strengthening policy coherence and coordination between environmental and skills policies can expedite the implementation of climate commitments

Evidence suggests there is a strong correlation between well-matched environmental and skills policies and existing institutional mechanisms for inter-ministerial coordination (ILO, 2019a). Such mechanisms are also important for achieving a greater balance between strategic social and economic policies and careful assessment of their environmental impacts. It is certainly important to coordinate also with other public policies and strategies, including macroeconomic, investment, industrial, trade, sectoral, social policies to ensure inclusion issues, including gender are adequately addressed.

Alongside improved coherence and coordination at national level, decentralized approaches at sectoral and local levels are recognized as having the potential to achieve policy coordination and coherence on the ground. Thus, a combination of top-down coordinated policymaking and bottom-up initiatives could provide effective and sustainable support to the green transition.

A just transition will require a joint and active engagement by governments, employers' and workers' organizations through social dialogue, and engagement with civil society actors and education and training providers at all levels as well as international community. In other words, effective skills and climate response strategies must be grounded on broad participation of all relevant stakeholders to have a chance of successful design, planning and implementation.

In general, coordination within government as well as with social partners is facilitated by the presence of institutional structures in the G7 and EU countries. For instance, France provides a good example for creating specific institutions and skills policies to support environmental sustainability and green jobs while bringing key stakeholders together (Box 3). Yet, underestimated role of skills development measures in the NDCs of G7 and EU countries show that there is still a room for improvement in terms of policy coherence and coordination between environmental and skills policies and this will help expediting the implementation of each country's climate commitments.

► Box 3. National coordination bodies related to skills for green jobs in France

France was in the forefront of policy coordination, implementing the Grenelle de l'environnement (environment round table) in 2007 and linking the public sector with civil society and social partners at national, sectoral and local levels. In 2012, a new principle of an annual national climate conference was introduced to re-ignite enthusiasm for the multi-level governance process introduced by the Grenelle. These conferences brought together the five partners that met within the framework of the Grenelle: the State, employers, unions, local authorities, and non-government organizations. Alongside these developments, the National Observatory for Jobs and Occupations of the Green Economy (Onemev) was created in 2010 by the Ministry of Environment to analyse employment shifts and occupational implications and produce relevant methodologies and statistics. It brings together a broad range of institutions including relevant national ministries and agencies, key public employment service organizations, the main TVET association, the national statistical institute, research bodies (including the Centre for Studies and Research on Employment and Skills), and regional employment and training observatories.

Source: ILO (2019a), Skills for a greener future: A global view

5.3 Reinforcing labour market intelligence and skills anticipation systems can enhance understanding of changing skills demand in the green transition

Systematic, innovative and institutionalized mechanisms for labour market intelligence and skills anticipation, in which the private sector is directly and actively involved is critical to understand changing skills demand in the labour market (OECD, 2016). Most G7 and EU countries have initiatives in place for skills anticipation in relation to skills for green jobs, although skills anticipation for the green economy is part of overall skills anticipation systems and permanent mechanism addressing the green economy is not yet common with a few exceptions like France. Yet, recent development of new taxonomy of skills for the green transition in European Skills, Competences, Qualifications and Occupations (ESCO) may provide a better guidance and reinforce labour market intelligence on skills for green jobs in the EU and serve as a reference for other countries (see Box 4).

► Box 4. New EU taxonomy of skills for the green transition

At the beginning of 2022, the European Commission published a new taxonomy of skills for the green transition in European Skills, Competences, Qualifications and Occupations (ESCO). "ESCO skills and knowledge concepts needed to live in, develop and support a society which reduces the impact of human activity on the environment are now labelled as green." The labelling methodology was based on Machine Learning (ML) algorithms in combination with manual validation and labelling. As a result, a total of 571 ESCO skills and knowledge concepts are labelled as *green*: 381 skills, 185 knowledge concepts, and 5 transversal skills.

The New EU green taxonomy contributes to building a common understanding of which skills are needed for a green transition in the labour market while providing information on which skills and knowledge concepts are essential or optional for specific occupations. The full list of green concepts is publicly available in the ESCO portal and this can be employed by various actors such as the Public Employment Services to suggest greener career pathways; private companies and human resource services to forecast the impact of green investments on the skills needed by the company; research bodies to collect data and information on skills for green transition; and education and training providers to green their programmes for the future greener workforce.

Source: European Commission (2022), Technical Report on Green Skills and Knowledge Concepts: Labelling the ESCO classification

There are different institutional approaches, and quantitative and qualitative methods for skills anticipation in relation to skills for green jobs. Some countries have established systems of sector skills councils, and their typical functions include skills anticipation. Some countries have established a single central skills anticipation institution at national level, incorporating representatives of social partners and other stakeholders. For example, France has established a national observatory of employment and occupations for the green economy (L'observatoire national des emplois et métiers de l'économie verte) to analyse national and regional trends in jobs and skills in the green economy.⁴

Quantitative green employment projections by sector and occupation can be used to analyse trends of demand and supply of labour in the sectors that contribute to decarbonisation. Depending on the needs, the forecasts could be produced to identify the short-term skill needs or longer-term needs at national and or subnational level. In practice, however, qualitative analysis is required to inform the quantitative analysis in the context of the green transition. Such qualitative methods include surveys, focus groups, expert interviews, foresights and scenario development. With the surge of online platforms online job vacancies and applicants' profiles information on skills demand and

⁴ For further details, see <https://www.ecologie.gouv.fr/observatoire-national-des-emplois-et-metiers-leconomie-verte>.

supply is available for big data analytics, including the ones on skills for green jobs. As it provides granular data, almost in real time in ways that are not always possible, when using traditional methods, it is considered as one of feasible options to analyse the changing skills requirements on the labour market in more timely manner, with some caution over issues of non-representativeness and measurements errors.

► **Box 5. EU and international efforts on skills anticipation for the green transition**

Cedefop skills forecasts provides comprehensive information on future labour market trends in all EU Member states plus a few more countries, offering quantitative projections of the future trends in employment by sector of economic activity and occupational group. It uses harmonised data and a single methodology to make results comparable across countries, sectors and occupations which can be aggregated to provide an overall picture of labour market trends and skill development in the EU. Although it does not intend to substitute national skills anticipation and forecasting initiatives, the forecasts and the methodologies applied are validated by a group of national experts. Insights from the skills forecast are further applied for thematic research works, including on skills for green transition.

The **ILO** has been providing policy advice and conducting applied policy research with the aim of helping countries to improve their skills anticipation and labour market information systems in the context of the green transition. The ILO has implemented two rounds of national studies on skills for green jobs. The recent round of research (2019) "Skills for green jobs: A global view", included analysis of 32 countries, and over 100 case studies on how countries respond to requirements for a new and emerging occupations in different ways. The report includes global employment projections until 2030 by exploring both the energy sustainability and circular economy scenarios and their implications for skills, gender and occupations.

The **OECD** is currently working with countries to identify the most effective and innovative approaches to carry out skills anticipation for the green transition. A particular focus is placed on the governance structures of these exercises and on how the estimates, once produced, feed into employment, education and migration policies.

Sources: Cedefop (2021a), The green employment and skills transformation: Insights from a European Green Deal skills forecast scenario; Cedefop (2021b), Digital, greener and more resilient: Insights from Cedefop's European skills forecast; ILO (2019a) Skills for a Green Future. A Global View.

5.4 Mainstreaming skills for green jobs in education and training at all levels is vital to equip the future workforce with relevant technical and core skills for the green transition

The shift to low-carbon and resource-efficient economies and societies requires education and training providers at all levels, particularly TVET, to engage more systemically in response to the changing job opportunities and skills needs for the green transition. It has the potential in ensuring the green transition is fair and just by preparing the current and future workforce with the relevant knowledge and skills to transform the workplaces, communities and societies as a whole. It is therefore essential to strengthen governance and management structures required to mainstream green transition in education and training at all levels and in particular to incorporate relevant skills into the development or renewal of competency standards, curricula, training, and assessment packages in both initial and continuing TVET (see Box 6).

► **Box 6. Key elements for mainstreaming skills for green jobs in education and training systems**

Mainstreaming skills for green jobs in education and training requires a systemic and holistic approach, with an active engagement of various key stakeholders such as policy-makers, social partners, enterprises, and education and training institutions. It involves updating or adapting competency standards and curricula tuned to industry needs, which should be based on a solid system of skills anticipation. It also involves ensuring that the physical environments around teaching (schools and campuses) and learning contribute to the development of environmental awareness and behaviours.

In addition, the availability of teachers and trainers with current knowledge on sustainable land and ecosystem management, energy efficiency and green technologies as well as skills to use appropriate pedagogies and assessment methods to support the development of core skills and technical skills for green transition is crucial. The education and training of such teachers and trainers should therefore be included in any skills strategy. Moreover, sensitising and encouraging enterprises to engage in this process is important as they can better inform the education and training providers on changing demand for skills in the labour market and offer more practical learning and work opportunities for students and trainees with work-based learning (WBL).

Source: ILO (2022b, forthcoming). Greening TVET and skills development: A practical guidance tool

5.5 Promoting women's participation in greening the economy through relevant skills development and training provisions will increase the chance of advancing a just transition

The inclusion of women in apprenticeship and skills training for environmentally sustainable jobs, particularly where women are underrepresented is essential to overcome gender gaps as well as skills shortages in certain occupations. Incentives to increase women's participation in sectors with green growth potential, notably through technical training programmes, including STEM, will achieve the double objective of solving skills shortage problems in this area while also increasing women's participation in technology-driven occupations. Gender bias in education and training needs to be addressed with more targeted measures, based on a solid understanding and knowledge of how different groups of women are affected by different factors contributing to occupational disaggregation by gender (ILO 2020).

Gender-sensitive education and training environment is important, and the role of teachers and trainers as well as managers of education and training institutions in the prevention of stereotyping and raising interest of female students in non-traditional occupations cannot be overestimated (ibid). However, having more female students in training for specific occupations, including those related to greening economy, does not automatically lead into more participation of women in those sectors. Effective career guidance can lead more female students to take up traditionally male-dominated green jobs. Mentorships and positive role models among women in non-traditional occupations could also be effective to raise awareness of various career opportunities and attract more girls and women (see an example in box 7).

► **Box 7. Women in Renewable Energy (WiRE)**

Women in Renewable Energy (WiRE) was launched in 2013 in Canada and is now active internationally. To advance the role and recognition of women in the renewable energy sector, it offers mentoring, provides networking opportunities in partnership with government agencies and renewable energy associations, and organises capacity-building field trips.

WiRE supports the Leadership Accord for Gender Diversity in Canada's Electricity Sector, a 2017 commitment by employers, educators, unions and governments to increase the representation of women in the electricity and renewable energy sectors. WiRE also supports the Equal by 30 Campaign for equal pay, equal leadership and equal opportunities for women by 2030.

WiRE awards Student Bursaries to women in college or university. These bursaries are designed to support women to help them explore opportunities for internships and permanent positions in the energy sector.

Source: IRENA (2019), Renewable energy: A gender perspective; WiRE official website

5.6 Encouraging investments in skills at the enterprise and industry levels will propel the green transition

It is important to recognise that transitioning to resource efficient and lower carbon processes begins at the workplaces. Empowering enterprises and industries to be on board for the green transition to fully take advantage of the potential opportunities is paramount. This requires supporting their skills development for the green economy, especially among micro-, small- and medium-sized enterprises (MSMEs) as they often lack resources to provide training on their own.

There can be various ways to encourage enterprises and industries to engage in the greening agenda. Public-private partnerships (PPPs) for green jobs and skills development can be useful to meet training needs. PPPs can catalyse and boost diversified and innovative in financing lifelong learning, foster collaborative peer learning and knowledge sharing among businesses, workers and training institutions on the application of green technologies and practices, and provide a platform for joint efforts to support education systems more broadly. Fostering close collaboration between businesses is another way to activate skills response at the enterprise and industry level. It can be especially helpful for MSMEs that face a number of obstacles in terms of financial and human resources (see example in Box 8).

► **Box 8. Inter-company vocational training centres in Germany**

Germany has a network of inter-company vocational training centres (überbetriebliche Bildungszentren), some of which focus on environmental issues, and play an important role in the promotion of skills for green jobs and green technologies, especially in the absence of other training support measures for SMEs. Very often, new advanced content for skills programmes related to skills for green jobs is developed in such centres and thereby made accessible to a large number of firms, especially SMEs.

Source: ILO (2019), Skills for a Greener Future: A global view.

Trade unions can play an active role in inspiring employers to promote skills development of their workers in the context of the green transition and ensure that upskilling and reskilling plans are included in their collective bargaining agreements and human resource development strategies (see an example in box 9). Financial incentives

are a key aspect of the operation of green markets. Some countries operate specific financial incentives to encourage training, such as levy-grant systems, tax breaks, training vouchers and individual training accounts.

► **Box 9. UK's unionlearn develops environmental workplace representatives**

In the UK, the national umbrella body, the Trades Union Congress (TUC) plays an active role in supporting learning in the workplace. Through its Learning and Skills Organisation, unionlearn, it manages the Union Learning Fund (supported by government) to help union learning representatives work with employers on TVET issues. The TUC also supports its member unions to develop green or environmental workplace representatives, recognising that encouraging employers to focus on green issues can lead to the creation of new green jobs and skills. Through discussion with employers, union representatives are reaching agreements to extend the scope of union activities to cover environmental issues such as energy use, recycling and green travel plans and working with employers to train staff.

Source: ILO (2022b, forthcoming), Greening TVET and skills development: A practical guidance tool.

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► Annex 1: Methodological Note

We selected countries in G7 and EU (31 unique countries) from the country-industry-level net-employment estimates⁵ obtained from EXIOBASE v3⁶. Next, we extended the net-number of jobs created or destroyed for each country and industry pair (31 countries × 163 industries) by taking the product of the corresponding International Standard Industrial Classification, Revision 4 2-digits code (ISIC-2D) against the International Standard Classification of Occupations 2008 2-digits code (ISCO-2D) structure. For the countries that did not have data on the occupation and/or industry level of detail required, they were replaced by another similar country with similarity determined by minimising the absolute gross national income (GNI per capita in U.S. dollars 2014, Atlas method) difference. The use of GNI per capita to measure the similarity between countries is a viable one given that majority of countries are high-income economies that have fairly low level of informality. We only considered data after 2014 for consistency with the baseline year used to model the scenarios (see ILO 2018).

To derive the occupation shares for the average country, for each country (17 unique countries) with available data, we computed the ISCO-2D occupation shares for each ISIC-2D, with each occupation weighted by (1) the share of that occupation within the industry as well as (2) the share of that occupation across all industries. Doing so accounts for biasness introduced due to sample size issues by penalising the appearance of rare occupations in some industries. We obtained the average occupation share by taking a simple average across all countries.

To obtain the gender shares for the average country, for each country, we computed the gender shares at (1) ISCO-2D level of detail (broad) and (2) ISIC-2D and ISCO-2D level of detail (detailed). For each level of detail, the gender shares of the average country were computed by taking a simple average. In the event detailed gender shares were not available due to sample size constraints, these were replaced by broad gender shares. Next, we distributed the net-employment for each ISIC-2D and ISCO-2D according to the occupation and gender shares of the average country. For the computation of occupation and gender shares of the average country, a sample size threshold of greater than 10 observations were used.

Occupation-level results on the estimated number of jobs filled by workers whose jobs had been destroyed (Jobs destroyed reallocatable) as well as jobs that need to be filled through entirely new skills development (New jobs), and jobs that would be destroyed with no possibility of reallocation (Jobs destroyed not reallocatable) is estimated by comparing the estimated creation and destruction of jobs in each occupation as follows:

$$\begin{aligned} \text{New Jobs}_{\text{reallocation}} &= \begin{cases} \text{Jobs}_{\text{destroyed}}, \text{Jobs}_{\text{destroyed}} \leq \text{Jobs}_{\text{created}} \\ \text{Jobs}_{\text{created}}, \text{Jobs}_{\text{destroyed}} > \text{Jobs}_{\text{created}} \end{cases} \\ \text{New Jobs}_{\text{net}} &= \begin{cases} \text{Jobs}_{\text{created}} - \text{Jobs}_{\text{destroyed}}, \text{Jobs}_{\text{destroyed}} < \text{Jobs}_{\text{created}} \\ 0, \text{Jobs}_{\text{created}} \leq \text{Jobs}_{\text{destroyed}} \end{cases} \\ \text{Jobs Lost}_{\text{reallocation}} &= \text{New Jobs}_{\text{reallocation}} \\ \text{Jobs Lost}_{\text{net}} &= \begin{cases} \text{Jobs}_{\text{destroyed}} - \text{Jobs}_{\text{created}}, \text{Jobs}_{\text{destroyed}} > \text{Jobs}_{\text{created}} \\ 0, \text{Jobs}_{\text{created}} \geq \text{Jobs}_{\text{destroyed}} \end{cases} \end{aligned}$$

⁵ For more details on the scenarios explored, refer to Appendix 2 in ILO (2018).

⁶ EXIOBASE is available through the project's website: www.exiobase.eu [accessed 3 May 2022].