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Just transition in the context of EU environmental policy and the European Green Deal

Issue Paper under Task 3 of the
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Background

This study was drafted in view of preparing for an 8th Environment Action Programme (EAP), as the 7th EAP expires at the end of 2020.

According to the 2020 'State of the Environment' report, Europe "faces environmental challenges of unprecedented scale and urgency". Therefore, "Europe needs to find ways to transform the key societal systems that drive environment and climate pressures and health impacts – rethinking not just technologies and production processes but also consumption patterns and ways of living".

The European Commission adopted in December 2019 a communication on and roadmap for a 'European Green Deal', aiming for a transformation towards a climate-neutral, zero-pollution and circular economy, while aiming for a "just transition" that "leaves no one behind".

Summary

The envisaged sustainability transitions are expected to substantially improve the state of our environment but also public health and the quality of peoples' lives. Moreover, many economic sectors depend on ecosystem services and green technologies create new jobs. However, transitions do not happen without trade-offs, conflicts and resistance. In the case of climate and other sustainability transitions, the decline of incumbent firms, e.g. in the oil and coal business, can have negative (regional) economic and employment effects. Moreover, if energy or other commodity prices rise, this may disproportionately affect low-income households. Effective and socially acceptable transition governance should take such potentially negative effects seriously and address them.

Following the Commission's task assignment, this issue paper primarily focuses on potential *negative* social impacts of environmental (transition) policies – with regard to jobs/workers and regions as well as consumers/households – and ways to mitigate such impacts on a European and national level. Moreover, the paper focuses on intra-EU socioeconomic effects and distributional justice rather than international, procedural or recognitional justice. The whole paper is based on a review of existing research literature and policy documents.

We start by clarifying the term "just transition" and conceptually systematising different positive and negative social (socioeconomic) impacts of environmental transitions and policies. We continue to discuss potential negative impacts in more detail, for both workers and consumers, along different EU environmental policy areas, taking into account the European Green Deal agenda: climate neutrality & energy policy; circular economy & resource efficiency; biodiversity & land-use; and "zero pollution" (clean air & water, safe chemicals & products). We then go on to categorise and discuss possible policy measures to mitigate these impacts (including some good practice examples from past transitions) before finally formulating recommendations for future EU policy to avoid social injustice when working towards the transition to an environmentally sustainable Europe.

The main added value of this study is not in the level of detail relating to specific impacts and recommendations, but in its holistic approach raising awareness for environment policy's social effects among a broad range of areas and actors, with a view to identify possible future work strands.

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Abbreviations

AAQ	Ambient Air Quality (Directive)
BAU	Business as usual
BPIE	Buildings Performance Institute Europe
CAP	Common Agricultural Policy
CE	Circular Economy
CFP	Common Fisheries Policy
CLP	Classification, Labelling, and Packaging (Regulation)
EAP	Environmental Action Plan
EC	European Commission
EEA	European Environment Agency
EEG	German Renewable Energy Sources Act
EGD	European Green Deal
EHERO	Erasmus Happiness Economics Research Organization
EPO	Energy Poverty Observatory
ETS	Emissions Trading System
EU	European Union
FoE	Friends of the Earth
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GMO	Genetically modified organism
IED	Industrial Emissions Directive
IISI	International Institute for Sustainable Development
ILO	International Labour Organization

IPCC	Intergovernmental Panel on Climate Change
ITUC	International Trade Union Confederation
JRC	Joint Research Centre
JTC	Just Transition Centre
MCP	Medium combustion plants
MS	Member States
MSFD	Marine Strategy Framework Directive
NEC	National Emissions Ceilings (Directive)
NGO	Non-governmental organization
OECD	Organisation for Economic Co-operation and Development
PM	Particulate matter
R&D	Research & Development
RE	Renewable Energy
REACH	Registration, Evaluation, Authorisation, and Restriction of Chemicals (Regulation)
SDGs	Sustainable Development Goals
SME	Small- and medium-sized enterprises
SRU	German Advisory Council on the Environment
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
WHO	World Health Organization

1. Introduction

According to the 2020 'State of the Environment' report, Europe "faces environmental challenges of unprecedented scale and urgency" (EEA 2019a). Therefore, "Europe needs to find ways to transform the key societal systems that drive environment and climate pressures and health impacts – rethinking not just technologies and production processes but also consumption patterns and ways of living. […] This will require immediate and concerted action, engaging diverse policy areas and actors across society in enabling systemic change" (EEA 2019a). In particular, limiting global temperature rise to 1.5°C necessitates rapid, far-reaching and unprecedented changes (IPCC 2018).

To denote this deep change, the terms "transformation" or "transition"[1] have rapidly spread among scientific studies as well as policy documents. For example, the UN 2030 Agenda, with its 17 Sustainable Development Goals (SDGs), is titled "Transforming our World" (UN 2015). The European Commission's "Reflection Paper" on the 2030 Agenda refers repeatedly to the need for a sustainability transition to achieve the SDGs (EC 2019a). The Commission's long-term vision for a climate-neutral Europe also affirms that achieving net-zero greenhouse gas emissions by 2050 will require "economic and societal transformations" (EC 2018a). The concept also appears in an increasing number of national sustainability strategies, e.g. of Belgium, Finland, France and Germany.

Within the environmental sustainability discourse, "transition" often refers to fundamental changes of key production and consumption systems – like energy, transport or agriculture and food. In academic literature, sustainability transitions are defined as profound shifts of such socio-technical (or socio-economic) systems by interrelated changes in technologies, infrastructure, products, consumer behaviour, societal values, and politics (see EEA (2017a) for a literature overview and Wolff et al. (2020) for concrete governance approaches of a "transformative environmental policy").

The envisaged sustainability transitions are expected to substantially improve the state of our environment but also the quality of peoples' lives, especially for future generations, compared to a baseline scenario of continued environmental degradation. Environmental protection and climate change mitigation preserve or improve public health and well-being, particularly of vulnerable societal groups (see ILO 2018a; WHO 2018). Moreover, many economic sectors and jobs depend on ecosystem services, and green technologies have created new jobs and are excepted to create more in the future (see DG EMPL 2019; EC 2018b; ILO 2018a; NEC 2018; OECD 2012; UNEP et al. 2008).

However, as historical and ongoing system transitions show, such processes do not happen without trade-offs, conflicts and resistance since they disrupt and challenge established investments, jobs, behaviours, knowledge and values (EEA 2019b). In the case of climate and other sustainability transitions, the decline of incumbent firms, e.g. in the oil and coal business, can have negative (regional) economic and employment effects. Regions which lack diversification and have a limited capacity for innovation will face the greatest challenge, as will workers with skills that are in less demand or who are unable to acquire new skills (UNFCCC 2016). Moreover, if energy or other commodity prices rise in the course of environmental transitions, this may disproportionately affect low-income households. Both effects are likely to provoke resistance against transitions, even more when they are politically initiated or pushed forward. Recent examples are the French yellow vests' protests against (inter alia) rising fuel taxes and German coal miners' protests against a coal phase-out.

[1] While the two terms' origins and main application fields in academic literature differ, there is no broadly accepted and consistent distinction between them (Hölscher et al. 2018). We also do not distinguish between the two terms in this paper and mainly speak of "(just) transition", as this is currently the more usual term in international policy discourses.

Effective and socially acceptable transition governance should take potential negative effects seriously and address them. In addition to promoting new and long-term prospects, it should be a political responsibility to avoid short-term economic hardships and social inequalities caused by transitions. The term **Just Transition** has been taken up over the last years and become recognised by UN bodies and conferences, e.g. within the Paris Climate Agreement. The European Commission's long-term vision for a climate-neutral Europe 2050 speaks about "ensuring a fair and socially acceptable transition for all in the spirit of inclusiveness and solidarity" (EC 2018a).

Taking up the challenge, the European Commission adopted in December 2019 a communication on and roadmap for a '**European Green Deal**' (EGD) (EC 2019b). The strategy aims "to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use. It also aims to protect, conserve and enhance the EU's natural capital, and protect the health and well-being of citizens from environment-related risks and impacts. At the same time, this transition must be just and inclusive. It must put people first, and pay attention to the regions, industries and workers who will face the greatest challenges" (ibid.).

Key points of the EGD are, inter alia:

- a European Climate Law enshrining the 2050 climate neutrality objective, and an increase of the EU's greenhouse gas emission (GHG) reduction target for 2030 with appropriate policy revisions
- new action plans on a Circular Economy (including a sustainable products policy initiative) as well as on "zero pollution" of air, water and soil
- a greening of the Common Agricultural Policy (CAP) and a "Farm to Fork Strategy" for sustainable agriculture and food consumption, as well as new strategies on biodiversity and on forests
- a Sustainable Europe Investment Plan to meet the funding needs, together with a Just Transition Mechanism (JTM), including a Just Transition Fund (JTF), "to leave no one behind". "The Just Transition Mechanism will focus on the regions and sectors that are most affected by the transition because they depend on fossil fuels or carbon-intensive processes. […] It will also strive to protect the citizens and workers most vulnerable to the transition" (EC 2019b).

The European Green Deal agenda and its ambition for a Just Transition provides the background for this issue paper. Following the Commission's task assignment, it primarily focuses on potential *negative* social impacts of environmental (transition) policies and ways to mitigate such impacts on a European and national level. Moreover, it focuses on intra-EU socioeconomic effects and distributional justice rather than international, procedural or recognitional justice (cf. Jenkins et al. 2018).

We start by clarifying the term Just Transition and conceptually systematising different social (socioeconomic) impacts of environmental transitions (Chapter 2). We continue to discuss potential negative impacts in more detail for different EU environmental policy areas (Chapter 3). We then go on to categorise and discuss possible policy measures to mitigate these impacts (Chapter 4) before finally formulating recommendations for future EU policy to avoid social injustice when working towards the transition to an environmentally sustainable Europe (Chapter 5). The whole paper is based on a review of existing research literature and policy documents (mainly from 2010 onwards).

2. Conceptual clarifications on environmental policy & social justice

2.1. Evolution, political uptake and understanding of "Just Transition"

The term "Just Transition" emerged in the late 1970s when the US Oil, Chemical, and Atomic Workers Union sought support for workers whose jobs were threatened by environmental regulation (Gambhir et al. 2018). In the 1990s, the union pleaded for a "superfund for workers" to provide financial support and opportunities for higher education for workers in affected industries. By 1997, several US and Canadian unions had endorsed the Just Transition principle (Galgóczi 2018).

On the transnational level, trade unions and their international confederation (ITUC) started to include Just Transition in their stakeholder statements to global climate and sustainability conferences, starting with the Kyoto Conference in 1997. The concept first made it into an official decision at the climate conference in 2010 in Cancun (Galgóczi 2018).

In 2013, the International Labour Organization (ILO) adopted a "Resolution concerning sustainable development, decent work and green jobs" which refers to Just Transition (see text box). Following up on the resolution, the ILO published the more concrete "Guidelines for a just transition towards environmentally sustainable economies and societies for all" in 2015. The Guidelines shall "provide non-binding practical orientation to Governments and social partners with some specific options on how to formulate, implement and monitor the policy framework, in accordance with national circumstances and priorities" (ILO 2015). The Guidelines became a standard reference in the debate.

Both the **ILO Resolution** (ILO 2013) and the **ILO Guidelines** (ILO 2015) state:

"A just transition for all towards an environmentally sustainable economy, as described in this document, needs to be well managed and contribute to the goals of decent work for all, social inclusion and the eradication of poverty. (…)

In the transition to environmentally sustainable economies and societies, the world of work can benefit from some major opportunities, (…); and faces some major challenges, for example:

(d) economic restructuring, resulting in the displacement of workers and possible job losses and job creation attributable to the greening of enterprises and workplaces;

(e) the need for enterprises, workplaces and communities to adapt to climate change to avoid loss of assets and livelihoods and involuntary migration; and

(f) adverse effects on the incomes of poor households from higher energy and commodity prices."

The Preamble to the 2015 Paris Agreement also refers to Just Transition by committing to "tak[e] into account the imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities". At the climate conference in 2018 (UNFCCC COP-24), the "Solidarity and Just Transition Silesia Declaration" was adopted.

The **Silesia Declaration** on Solidarity and Just Transition states (COP24 2018):

"We, the Heads of State and Government (…)

1. Stress that just transition of the workforce and the creation of decent work and quality jobs are crucial to ensure an effective and inclusive transition to low greenhouse gas emission and climate resilient development, and to enhance the public support for achieving the-long term goals of the Paris Agreement;

2. Emphasize that development measures to make infrastructure climate- resilient and enhance institutional capacity in this respect have the potential to be a source of decent jobs creation for both women and men while improving resilience, especially in vulnerable countries;

3. Underline employment opportunities that the transition to low-green- house gas emission and climate resilient economies have already created and the potential for the creation of a number of additional jobs as a result of increased global ambition;

4. Recognize the challenges faced by sectors, cities and regions in transition from fossil fuels and high emitting industries, and the importance to ensure a decent future for workers impacted by the transition, while working to ensure sustainable development and community renewal;

5. Note the importance of a participatory and representative process of social dialogue involving all social partners to promote high employment rates, adequate social protection, labour standards and wellbeing of workers and their communities, when developing nationally determined contributions, long-term low greenhouse gas emission development strategies and adaptation planning processes; (…)".

A report by the Just Transition Centre, initiated in 2016 by ITUC and partners, stresses that Just Transition is more than softening job losses. Rather, it is a deliberate effort to plan for and invest in a transition to environmentally and socially sustainable jobs, sectors and economies (JTC 2017).

Given its origins in the labour movement, policy documents as well as academic literature on Just Transition focus primarily on jobs, workers and communities (Mertins-Kirkwood 2018). Potential impacts of environmental policies on people in their role as citizens and consumers have tended to be dealt with in other strands of literature and discourses so far. The following table contrasts two definitions, one of the Just Transition Centre – with a clear focus on workers' well-being – and one of environmental NGO Friends of the Earth that includes different aspects of justice.

Definition by ITUC Just Transition Centre	Definition by Friends of the Earth
"A Just Transition secures the future and livelihoods of workers and their communities in the transition to a low-carbon economy. It is based on social dialogue between workers and their unions, employers, government and communities. A plan for Just Transition provides and guarantees better and decent jobs, social protection, more training opportunities and greater job security for all workers affected by global warming and climate change policies" (JTC n.d.).	"By 'just' we mean: some chance of a safe climate for future generations; an equal distribution of the remaining global carbon budget between countries; and a transition in the UK in which the costs are distributed progressively, and where everyone's essential needs for housing, transport and energy use are met" (FoE 2011).

It is not surprising that there is not one single understanding of Just Transition. As Bennett et al. (2019) write: "deciding what constitutes a fair or just distribution is complicated by underlying philosophies and 'equity criteria' (i.e., utility, equality, proportionality, needs, merit, and rights […]) that are often implicit in environmental and sustainability decision-making processes". Moreover, the interlinkages between ecological sustainability and social justice are manifold, as the next sections show.

2.2. Other concepts on linkages between ecology, energy and social justice

As already pointed out above, environmental policy can have large positive impacts not only on the environment but also on society. This holds, for instance, for job creation and income levels (ILO 2018a; NEC 2018; UNEP et al. 2008), workers' and generally public health (ILO 2018a; WHO 2018) as well as social justice and equity (see, e.g., Doranova et al. 2018).

The nexus between environmental and social issues is central to the discourses on "energy justice", "climate justice" and "environmental justice". The "**environmental justice**" discourse (and the related civil society movement) has a long tradition in addressing the distribution of environmental hazards (and, as a result, health risks) and access to natural resources, both of which are often socially unequal. It includes equal protection from burdens, meaningful involvement in decisions (procedural justice), and fair treatment in access to benefits (cf. Holifield et al. 2018). "**Climate justice"** addresses the sharing of benefits and burdens of climate change from a human rights perspective, adding both an intergenerational and an international justice perspective (cf. Jafry 2019).

With regard to "**energy justice**", Sovacool & Dworkin (2015) distinguish eight principles: availability and affordability of energy, due process, transparency, sustainability, inter-generational equity, intra-generational equity, and responsibility. The concern about energy affordability for low-income households draws from a long-established debate on "**energy poverty"** (or "fuel poverty"). While a uniform definition and measurement do not exist, energy poverty is broadly understood as the inability or difficulty to access or afford an adequate level of energy services for basic needs. The problem has also been recognised by the EU's "Third Energy Package" with regard to "vulnerable consumers".

While energy poverty was not initially associated with environmental (including climate) policy, the implications of decarbonisation policies on energy affordability is an emergent field of inquiry (Bouzarovski & Tirado Herrero 2017). Taxes or other policy measures that increase prices of basic commodities such as energy and food are expected to have regressive effects, i.e. affect low-income households disproportionately since they spend a comparatively high percentage of their income on these commodities (EEA 2011) (see also Chapter 3.1.2). Moreover, without attention to "energy justice", green technologies such as photovoltaic or electric cars might remain "exclusionary niches" for high-income households (Jenkins et al. 2018).

2.3. Systematisation of social (justice) impacts from environmental policies

The following Table 1 summarises and systematises potential social (justice) impacts of environmental policies and transitions, coming up from the screening of literature done for this paper (see reference list). While different ways of systematisation are possible, this one clearly distinguishes between positive and negative impacts, and potential biases of positive impacts. This differentiation makes it easier to focus on negative impacts (and their avoidance) as envisaged for this paper. Moreover, we broadly distinguish between impacts on jobs / workers and regional economies on the one hand and impacts on households / consumers on the other hand.

Table 1: Potential social (justice) impacts of environmental transitions & policies

	Potential impacts on jobs / workers & regions	Potential impacts on households / consumers
Positive impacts	• **Healthier working conditions** (e.g. by emissions or air quality standards) • **Long-term economic prosperity** and jobs depend on the preservation of resources, biodiversity and ecosystem services • **Avoiding high costs of inaction**: In the long run, not acting (especially on climate change and biodiversity) is more expensive in (socio-) economic terms	• **Well-being:** Less environmental degradation and pollution, safer products as well as better access to intact ecosystems and their services (food, clean air, water, climate stability etc.) secure livelihoods and benefit health and well-being • **Equality**: Environmental policies can also reduce inequalities in the distribution of environmental hazards and in the access to ecosystem services • **Inclusion**: Green infrastructures and public services improve social inclusion especially of low-income households (e.g., public gardens, public transport, bike lanes, sharing facilities)
Positive impacts with limitations	• **Cost savings**: Environmental policies can induce cost savings for both business and consumers (e.g., energy savings lower energy cost; more durable products lower costs for replacement; lower costs for environmental clean-up and public health generally decrease companies' and consumers' tax burden); however:	

		– **Social bias**: Some saving opportunities might not be (easily) available for everybody because of high upfront investment costs or because the investment depends on others (e.g., tenants in poorly isolated houses)
	• Green industries & services create **new jobs** & **income opportunities** – even beyond employees (e.g. renewable energy (RE) for farmers & homeowners); however:	
	– **Social & regional bias**: Jobs may not emerge equally among different sociodemographic / socioeconomic groups, skill levels, and regions – **Labour conditions**: New sectors may have inferior labour conditions such as pay, job security, worker protection, worker rights, etc.	– **Social bias**: Opportunities for (return on) investment in new technologies might not be (easily) available for low-income households – **Side effects**: New plants (e.g., factories for environmental goods, RE installations) may involve impairments of neighbours (e.g. emissions, noise)
Potential negative impacts *(See Chapter 4 for possible mitigation measures.)*	• **Sectoral job losses**: Destabilization, shrinkage or even exnovation[2] of "brown" industries may lead to job losses – which, if lasting, impair employees' livelihoods and quality of life • **Regional value creation**: Regions currently dependent on "brown" sectors could struggle with rising unemployment, shrinking tax revenues and public spending, possibly lowering infrastructure endowments and quality of life in the region and increasing territorial or social inequities	• **Reduced purchasing power:** Green taxes and price rises for (e.g. energy- / CO_2-intensive) products and services can disproportionately affect their affordability for low-income households or other vulnerable groups (e.g. migrants relying on air travel for family visits) • **Obstacles to inclusion**: Restrictions of resource-intensive goods challenge established ways of inclusion into society (e.g. traveling, symbolic consumption)

Source: Own compilation (Oeko-Institut)

2.4. Basic goals for socially just environmental policies

In view of the variety of social effects, three basic goals for socially just environmental policies can be defined, aiming for reinforcing positive, and for avoiding (limiting) negative or bias effects:

1. While generally improving the state of the environment to people's benefit, socially just environmental policies **reduce social & regional inequalities in the distribution of environmental health hazards & impacts**, **access to eco-system services** or regarding **social inclusion.**
2. Socially just environmental policies themselves **do not disproportionally burden vulnerable households** (e.g. low-income or rural households) and ensure that **financial (saving) opportunities are also available to them.**
3. Socially just environmental policies **positively affect quality and quantity of employment** and, together with structural policy, also **open up perspectives for workers and regions affected by the transition.**

[2] As flipside of innovation, "exnovation" means the purposive termination of existing (infra)structures, technologies, products and practices (Heyen 2017; Heyen et al. 2017).

3. Analysis of potential social impacts of EU environmental policy

In line with the task assignment for this paper, the analysis focuses on the potential negative impacts of EU and Member States' environmental policy while only briefly referring to positive impacts.

The chapter is based on a broad review of literature from academia and international organisations (mainly from 2010 onwards). One caveat is that experiences with profound sustainability transitions are rare, so that it is challenging and involves great uncertainties to estimate long-term impacts on economies, businesses, employment, vulnerable communities or consumers. In addition, there are many more studies available on climate policy than on other environmental policy areas.

The chapter is structured along four broad environmental policy areas, taking into account the European Green Deal agenda: climate neutrality & energy policy; circular economy & resource efficiency; biodiversity & land-use; and "zero pollution" (clean air & water, safe chemicals & products).

3.1. Climate neutrality & energy policy

In 2009, the EU set its objective to reduce GHG emissions by 80-95% in 2050. The energy sector has a central role to play as it is currently responsible for more than 75% of the EU's greenhouse gas emissions (EC 2018a). The main EU climate & energy policy instruments in place are the Emissions Trading System (ETS), national GHG reduction targets for non-ETS sectors under the Effort Sharing Regulation, CO_2 standards for vehicles, and energy efficiency standards (and labelling) for many appliances as well as energy performance standards for buildings.

Existing EU policies and current legislative proposals would lead to emissions reductions of around 60% by 2050, compared to 1990 (EC 2018a). This is not enough to achieve the Paris Agreement's goals. Given the IPCC's 1.5°C report (IPCC 2018) and the aim for climate neutrality by 2050 (EC 2018a), policy measures have to ensure much more ambitious emissions reductions.

3.1.1. Potential employment and regional economy impacts

- In general, **mitigating climate change is a prerequisite for global and long-term prosperity. It is also economically cheaper** in the long term than having to adapt to and deal with severe climate change in the future (Stern 2006). For example, the mitigation of climate change (including heat waves) can limit water scarcity and thus help many water-dependent sectors.[3]
- Most studies find that **employment gains have been achieved or are possible through climate policies** (Cambridge Econometrics et al. 2011; ILO 2012a; and following references). The 1.5° scenario in a Commission analysis points to potential net gains of 0.6% to 0.9%, or about 1.5 to 2 million jobs within the EU by 2050, compared with the baseline (EC 2018b). A modelling for 2030 shows a net employment gain of 0.5%, or 1.2 million jobs, in the EU, compared with the baseline (Eurofound 2019). An ILO report estimates that carbon emissions reduction measures in the energy sector alone will lead to a net increase of approximately 2 million jobs in the EU by 2030, and 18 million jobs (24 million new, 6 million lost) across the world (ILO 2018a). The New Climate Economy Report estimates a net employment gain of even 37 million jobs globally by 2030 through ambitious global climate action (NEC, 2018).

[3] Apart from the water supply sector, heavily water-dependent sectors are, for example, agriculture & food; chemicals & pharmaceuticals; mining & electricity production, and paper products. A study assessing a hypothetical scenario of reduced access to water found that the costs of alternative strategies or technologies (e.g. for water treatment) would be 15 to 55% higher than current total cost at an aggregate EU level (BLUE2 Consortium 2019).

- A recent OECD study analysing structural changes to the labour market induced by decarbonisation policies in line with a 450ppm CO_2 concentration target in 2035 found that the overall **reallocation of jobs (sum of jobs created and lost) would be around 0.3% for OECD countries** (Chateau et al. 2018). This rate is relatively small compared to reallocation during the past decades. One of the main explanations is that 82% of the largest, non-agricultural CO_2 emitting sectors account for only 8% of the total jobs in 27 OECD countries (OECD 2019a).
- A positive net employment result should not obscure the fact that far-reaching climate policies will have **large effects on fossil-fuel and carbon-intensive sectors**. Around 90% of total CO_2 emissions in the EU are attributable to ten industries: agriculture, hunting & forestry; fishing; mining & quarrying; electricity & gas; inland transport; air transport; water transport; other supporting & auxiliary transport activities; activities of travel agencies; coke, refined petroleum & nuclear fuel; chemicals & chemical products; other non-metallic mineral; basic metals (OECD 2012).
- There is a risk that carbon-intensive and globalised industries might relocate their production to parts of the world with less stringent emission constraints. This problem is referred to as **"carbon leakage"**. In the context of the ETS, a new list of 63 sectors and sub-sectors deemed to be at risk of carbon leakage in the 2021-2030 period was adopted in 2019, including some mining and extraction activities, aluminum production, pulp and paper etc. To secure their competitiveness, these sectors receive a higher share of free ETS allowances. However, for the period 2005-2012, Ecorys et al. (2013) found **no evidence of carbon leakage.**
- **Displacement problems related to a low-carbon transition are likely to be greater in countries with a greater concentration of employment in these high-pollution industries**. There are important differences across EU countries in the share of employment in these industries: it ranges from around 10% in Denmark up to nearly 30% in Poland (OECD 2012).
- **If a declining sector is regionally or locally concentrated and has played an important role for local communities, these areas are particularly affected**: Apart from direct job losses, purchasing power as well as municipal tax revenues are likely to decline, endangering the financing and maintenance of good transport, education, and leisure infrastructure, which in turn is important for attracting new industries and skilled workers.
- **Older and less educated workers tend to experience larger difficulties in finding new jobs**. Low-qualified workers are overrepresented in agriculture, mining and inland transport, while older workers are overrepresented in agriculture and water transport (OECD 2012).

Beyond these generic impacts, we will look deeper into impacts in specific sectors.

A) Energy production

- **In the long run, a net employment gain** by up to 250,000 jobs in the EU by 2050 is expected for the power sector due to increased electrification of the economy (EC 2018b).
- However, a **profound negative impact is expected on the mining and supply of fossil fuels and the subsequent energy generation, especially with regard to coal** (EC 2018b, Eurofound 2019), since the energy sector needs to achieve net-zero emissions the fastest.[4] A recent study argues that an almost complete coal phase-out by 2030 for OECD countries would be necessary (Climate Analytics 2017). In the longer term, for carbon neutrality in 2050, all fossil fuel operations will have to stop unless carbon emissions can be effectively captured and stored.
- In the EU, the coal sector provides about 185,000 direct jobs in coal mining and around 53,000 direct jobs in coal-fired power plants (Alves Dias et al. 2018). **Since coal mining is regionally**

[4] This is because carbon-neutral energy generation technologies are already available, and the decarbonisation of other sectors, namely heating, transport and industry, also relies on increased electrification and high amounts of electricity.

concentrated, mostly in regions in Eastern Europe (e.g. nearly 100,000 direct mining jobs in Poland alone), **and since these regions have often been economically dependent on the sector, a coal phase-out will have negative regional effects**.

- As fossil fuel-based firms leave the market, workers may face the **risk of (sometimes drastically) declining employer contributions to their pensions** (Botta 2018).
- While renewable energy is expected to create more jobs than are lost in fossil fuel-based energy production (ILO 2018a), the **new jobs might be created in other regions**. Currently, the Nordic countries have the highest proportion of workers in the RE sector (Pellerin-Carlin et al. 2017).
- Moreover, "green jobs" are not automatically "decent jobs". Jobs in the RE sector have sometimes been reported as having **problematic working conditions** (e.g. with regard to wages or rights to organise), compared to conditions in traditional energy sectors (ILO 2012b).

B) Energy-intensive industries & construction

- **Energy- and GHG-intensive industries such as cement, aluminium, steel, chemicals, paper and pulp or glass face similar risks**, until technological change makes their decarbonisation possible (EC 2018b; OECD 2017; UNEP et al. 2008). They will also be challenged by alternative solutions, improved resource efficiency or recycling of their outputs (see also Chapter 3.2). New business models could emerge, undermining or reinforcing incumbent companies.
- These industries **vary with regard to their geographic concentration**. Certain sectors, like "coke and fuel production" or "manufacturing of basic metals", are highly localised, especially in several former socialist countries, e.g. the Czech Republic, Poland, and Slovakia (OECD 2012). There is often a **strong cultural and territorial link between the work sites in these sectors and their communities**, which makes the transition politically more difficult (Rosemberg 2017).
- Job reallocation is also likely in the construction sector. While jobs might be lost in the carbon- and resource-intensive construction of new roads and buildings, more jobs could be created for the maintenance of transport infrastructures and energy efficient renovation of buildings. In a Commission analysis, all scenarios for 2050 show **net employment gains in the construction sector**, resulting from increased demand for energy-efficient structures (EC 2018b).

C) Transport sector

- Greening the transport sector is likely to result in large-scale realignments of employment (UNFCCC 2016): As petrol-driven vehicles are increasingly being replaced by electric mobility, **jobs will probably be lost in the automotive industry** (which is partly regionally concentrated). **This holds particularly for specialised suppliers,** since building electric cars requires less parts and manpower than assembling combustion engines (Bauer et al. 2018; Mönnig et al. 2019). Moreover, to date, cell and battery production mostly takes place in South-East Asia.
- However, job losses in the automotive sector **might be (over)compensated by new jobs in energy provision, public transportation** (growing infrastructure, operations and maintenance) **and new mobility services** (e.g. sharing) (ECF 2018; Wietschel et al. 2017).
- **Increased aviation taxes are predicted to have a (limited) negative impact on demand and, as a result, employment in the aviation industry** but job losses might be compensated by gains in other transport sectors (CE Delft 2019). The extent to which **aviation and shipping** will adapt to more ambitious climate mitigation is still to be confirmed, as these industries only make marginal efficiency gains which are overcompensated by growth rates. Further growth rates are also predicted despite difficulties in finding feasible carbon-neutral technological solutions (Rosemberg 2017; UNEP et al. 2008). Without such solutions, **job losses are likely**.

D) Agriculture & forestry

- Suggestions for decarbonising the agricultural sector range from increasing organic production to making agriculture "climate-smart". Model simulations by the OECD suggest that policies aiming to limit global warming to 2°C can induce global job reductions in agriculture of about 0.1% of total employment (OECD 2017). Job reallocation is estimated to be higher in some emerging economies (ibid.). A recent study on the EU shows **net employment gains by 2050** (significant under some scenarios) in agriculture and forestry **due to higher biomass demand** (EC 2018b). Climate change **adaptation policies are also expected to yield new employment in forestry through an increase in afforestation and reforestation** (ILO 2018b).
- Moreover, it can be assumed that **climate policies will limit the negative effects on employment and farmers' livelihoods** that would arise from the disastrous impacts of global warming on land and water resources.[5] The IPCC report on "Climate Change and Land" (IPCC 2019) refers to Jessoe et al. (2018) who – based on a 28-year panel in rural Mexico – found that years with a high occurrence of heat reduced local employment (both farm- and non-farm labour) by up to 1.4% with a medium emissions scenario. To the extent agriculture relies on manual labour, heat stress is expected to reduce the hours people can work (Dunne et al. 2013).
- Estimating **climate change effects on agricultural incomes** (not employment), the EEA points to large degrees of uncertainty: "Under the 2°C increase in global temperature, a 5% increase in total agricultural income is projected at EU level by 2050; however, this increase is mostly related to the assumed CO_2 fertilisation effect, the impacts of which are very uncertain. The increase in global production and the reduction in producer prices obtained by farmers as a result of CO_2 fertilisation may decrease total EU agricultural income by up to 16% by 2050" (EEA 2019c).

3.1.2. Potential consumer impacts

- While **green technologies manufactories and renewable energy installations can lead to local impairments** of neighbours, (measures for) **climate change mitigation in general is expected to have huge public health benefits,** particularly for vulnerable groups (WHO 2018).

A) Electricity & heating

- **When prices for electricity and heating rise due to energy or carbon taxation** (or indirectly through the EU ETS), this often has **regressive effects**, **i.e. low-income households are disproportionately affected,** having to spend a higher percentage of their income on energy (DG EMPL 2019; EEA 2016; OECD 2014; SRU 2016). **People spending most of their time at home, like the unemployed and pensioners, are also particularly affected** when energy prices rise.
- The **costs for expanding renewable energy might also be disproportionally borne by low-income households** if these costs are apportioned on energy bills as in the case of the German Renewable Energy Sources Act (EEG) (Bouzarovski & Tirado Herrero 2017; Cludius et al. 2015; Neuhoff et al. 2013). This is **aggravated by the fact that financially attractive opportunities for investment in and self-consumption of renewable (especially solar) energy are easier to take advantage of for wealthy homeowners than for low-income tenants**, for example.
- **Rising electricity prices also affect the cost and affordability of cooling in hot summers,** especially in Southern Europe (Pye et al. 2015). This can also **affect people's health**: It was

[5] Notably, land degradation and desertification, water shortages, increased rainfall intensity, flooding, drought frequency and severity, heat stress, dry spells, forest fires, wind, sea-level rise, frequency and intensity of dust storms, lower animal growth rates and productivity in pastoral systems, or the spread of agricultural pests and diseases (IPCC 2019).

estimated that 80,000 people died in the hot 2003 summer in Europe. **On the other side, policies to mitigate climate change contribute to avoiding even more heat stress in the future**.

- With regard to heating, between 50 and 125 million people in the European Union are estimated to be **unable to afford proper indoor thermal comfort** (BPIE 2014) – **which can also exacerbate health inequalities**. Households facing a combination of low income and inefficient homes are particularly vulnerable. There are **important differences between regions**: Higher levels of (self-reported) indoor thermal discomfort are mainly found in countries with a badly insulated building stock, inefficient heating systems and / or low purchasing power. These include Central and Eastern Europe, many Southern EU countries, but also the UK, Ireland and France (Bouzarovski & Tirado Herrero 2017; Pye et al. 2015; Schumacher et al. 2015).
- While such negative effects **could be neutralised by energy saving measures, people might not have the necessary knowledge and / or may lack the means (including the rights, in the case of tenants) to invest in energy-saving measures** (SRU 2016). A study on energy consumption in Germany shows that the average household was not able to compensate higher electricity and heating prices by reducing the amount of energy consumed (Cludius et al. 2015).
- Negative effects **could also be neutralised if appropriate changes were made to existing tax and benefit schemes** in parallel to energy taxation (OECD 2014). In Germany, for example, heating energy (but not electricity) for social welfare recipients is paid for by the government. Nonetheless, **there may still be vulnerable groups** that have to pay for their heating energy, especially those groups that are just above the transfer threshold (Cludius et al. 2018).
- With regard to heating, energy efficiency policy must take specific account of the so-called "landlord-tenant dilemma" on the distribution of costs and benefits in the case of energy-saving renovations of residential buildings (Greenough & Tosoratti 2014). There is a risk for tenants that **lower heating costs might be overcompensated by higher rents** due to renovation costs.

B) Mobility

- In contrast to electricity and heating**, the taxation of transport (fuels) generally does not have a regressive impact in terms of income**, **but rather a neutral or even progressive inequality-reducing effect** (Büchs et al. 2011; Ekins et al. 2011; Sterner 2012). The reason is that higher income households tend to spend more on (private) transport (DG EMPL 2019) while low-income households are less likely to own a car and fly less than richer households. However, there are **societal groups that are disproportionately affected by rising fuel prices,** especially rural households that need a car to get to work (or migrants visiting distant relatives, FoE 2011).
- **Well-developed public transport systems** (as well as cycling infrastructure) **can reduce negative impacts of rising fuel prices and improve the inclusion of low-income households**.

C) Food & water

- With agriculture and animal husbandry being important emitters of GHG emissions, **climate policy interventions such as meat taxes can lead to increased costs of (carbon-intensive) food**. Decarbonisation policies in other sectors, e.g. biofuel and energy crop promotion, might also substantially affect food prices through higher land and crop prices (Zachmann et al. 2018). As food remains a necessary and substantial part of household expenditure, ranging from 10% to 32% in Europe (EEA 2017b), and low-income households spend relatively more on it, this would again **have regressive impacts** on low-income households (Zachmann et al. 2018).
- On the other hand, **food price hikes can also result from the impacts of climate change, i.e. they can be curbed by mitigation policies**. The IPCC report on "Climate Change and Land" indicates that **particularly vulnerable groups in urban areas** are affected which are not well-

endowed with resources or are socially isolated (IPCC 2019). As climate change decreases yields, this can impact nutrient intake of poorer groups by decreasing the supply of highly nutritious crops, promoting resilient but less nutritious crops, and by promoting (in industrialised countries) calorie-dense but nutrient-poor diets. The latter are related to an increase in obesity and other diseases.

- **The mitigation of climate change (including heat waves) can also reduce freshwater scarcity and prices**. Around 30% of the total European population was exposed to water scarcity conditions in the summer of 2015. This was mainly the case in densely populated cities, agriculture-dominated areas of southern Europe and small Mediterranean islands (EEA 2018a). Additional desalination of the water supply would heavily increase consumer costs (Spit et al. 2018).

3.2. Circular Economy & (material) resource efficiency

The transition to a Circular Economy (CE) means maintaining the added value in products for as long as possible and eliminating waste. Emphasis is placed on waste prevention through efforts to reduce consumption, increase the lifespan and repairability of products, and improve overall resource efficiency. CE principles can thus contribute to the Sustainable Development Goals (SDGs) on clean water and sanitation, affordable and clean energy, decent work and economic growth, responsible consumption and production, and life on land (Schroeder et al. 2018).

In 2015, the EU adopted the Circular Economy Action Plan, which has now been fully implemented (EC 2019c). The Action Plan resulted in several new or amended directives and strategies, not least the amended Waste Framework, Landfill, and Packaging and Packaging Waste Directives (2018). A separate EU Strategy for Plastics in a Circular Economy (2018) led to the recent Single-Use Plastics Directive prohibiting some single-use plastic products (2009). Moreover, eco-design regulations, initially focused on energy efficiency, increasingly address also the lifespan, maintenance, repair, reuse, upgrade, recyclability, and waste handling of products (EC 2019d).

3.2.1. Potential employment and regional economy impacts

- Studies are to varying degrees **optimistic about the overall employment gains** that a CE could yield. For example, Cambridge Econometrics et al. (2018) find that a CE could increase employment by almost 0.3% in the EU. However, McCarthy et al. (2018) highlight that these findings are based on modelling exercises, and, often, narrow data. As such, it is difficult to generalise findings, and **the net employment effects of a CE remain uncertain**. Uncertainty is strengthened by the fact that the road to a CE is still long. In the EU, circular jobs were estimated to reach 3.9 million in 2014 (IISD 2018), which represented nearly 1.2% of the working age population. A study by Circle Economy and EHERO (2017) found that, in the Netherlands, 8.1% of jobs contribute to the CE today (both directly and indirectly[6]). The study further distinguishes between “core” and “enabling” jobs that directly contribute to a CE. The latter consist of higher-skilled jobs such as architects and data analysts, while the former category includes solar panel installers, technicians, and recycling operatives. Maintenance and repair jobs (i.e. “enabling” jobs) account for approximately 43% of circular jobs in the Netherlands, but data analysts are said to have the highest future potential. After the 2008 crisis, “indirectly” circular jobs (e.g. couriers, teachers) and “enabling” (directly) circular jobs decreased, while “core” (directly) circular jobs gained traction. This shows that although there are some opportunities for individuals with lower education levels, the situation remains less clear than for individuals with higher levels that can access “core” circular jobs.

[6] Circle Economy and EHERO (2017) define directly circular jobs (e.g. solar panel installers, recycling operatives, architects, data analysts), and indirectly circular jobs (e.g. couriers, teachers).

- The positive employment effects that are expected depend on **job reallocation and labour market restructuring** (OECD 2019a). A study by Cambridge Econometrics et al. (2018) revealed that the sectoral composition of employment will change: **sectors that produce and process raw materials will decline in size, while waste, recycling and repair sectors will benefit from additional growth**. In fact, the estimated overall employment effects (+0.3%) are largely based on employment gains in the waste management sector.[7] The services sectors and electricity are also expected to grow, while sectors that produce durable goods such as electronics, machinery, cars, and accommodation are expected to lose out.
- As consumption of new resources needs to decline**, resource-intensive industries (e.g. cement, steel, chemicals) face particular challenges** and have a long way to go to show that they can improve their supply chains, increase the amount of reused materials or transform their production processes. They require important investments in R&D, deployment, and employee upskilling to decarbonise and improve their material efficiency (OECD 2017; Rosemberg 2017). As mentioned in the Climate Chapter, some of these sectors are geographically concentrated.
- The **construction sector is expected to decline; however, this could potentially be compensated by energy efficiency improvements of buildings** (Cambridge Econometrics et al. 2018). The sector's challenges are to increase the sourcing of non-virgin, regenerative materials; to develop materials suitable for high-quality reuse; to design modular and adaptive building components; and to reclaim more waste through recycling and sector coupling (Circle Economy 2019).
- The **production of single-use plastics can be expected to decline**. The Packaging and Packaging Waste Directive already defines consumption reduction targets for lightweight plastic carrier bags of 50% by 2019 and of 80% by 2025 (in comparison to 2010). An impact assessment in 2013 showed only slightly negative employment effects (between minus 860 and 1,641 full-time equivalent jobs, depending on the policy option). The assessment also showed that profits for producers of multiple-use bags, paper bags and bin liners would increase in comparison to those of single-use bag producers (EC 2013; Eunomia 2012).
- Job reallocation entails both the movement of workers and the development of new skills. Research shows that the transition to a CE will be accompanied by **technological change, which will have even higher transformative effects on the labour market than the take-up of CE activities** (Cambridge Econometrics et al. 2018). **The required labour market transformations are, therefore, likely to accentuate vulnerabilities in society.** For example, individuals with lower levels of education (often originating from lower-income households) will be faced with a **growing "educational gap"** and will need to invest more in training and/or education. The **demand for digital skills may disadvantage parts of the ageing workforce.**
- Furthermore, **geographical disparities may increase**. The demand for "core" circular jobs may create more **movement towards city centres** (Circle Economy & EHERO 2017), leading to potential gentrification problems; but abandoned regions and areas may witness a revival thanks to a desired optimisation of land use (e.g. Wcycle Institute Maribor 2018). **Geographical disparities may also increase due to differing capacities of EU member states to incinerate or recycle waste** (JRC 2018).
- On a final note, **promoting the reuse of treated wastewater, especially in agricultural irrigation, is expected to have positive impacts on growth and employment** (EC 2018d).

[7] However, the modelling exercise conducted as part of the study used historical data to predict future employment effects. This means that the net employment gains in the waste management sector may not be as significant as they are predicted if technological change (e.g. automation) increases the overall productivity of the sector.

3.2.2. Potential consumer (and workers' health) impacts

- A **CE generally improves environmental and public health conditions.**
- However, if followed blindly, a CE **could also lead to the recycling of hazardous substances**, entering the market again (EC 2019e; RIVM & Ramboll 2019). For example, plastic components from electronic waste have been found to enter the plastic recycling stream, and later contribute to the production of toys for children. As such, there have been cases of toxic chemicals being found in toys (HEJSupport n.d.). Similarly, mineral oils have been found in recycled paper and cardboard food packaging. The latter results primarily from the recycling of newspapers and other printed media, or offset printing inks directly applied to the packaging (ANSES 2017).
- Thus, the overall aim should be of a "non-toxic" CE – both for the sake of consumers and of waste pickers and recycling operatives. The CE should not lead to a worsening of **working conditions within the waste management sector**, and of **communities surrounding waste management sites**. If these sites are concentrated in areas overlapping with poor communities, which do not have the resources to develop measures to deal with or mitigate the potential hazards of poor waste management, they will be at a disadvantage.
- To improve material efficiency, governments are looking at ways to **tax unwanted behaviour** and send the right price signals to consumers. In the context of a CE, examples of such taxes include resource taxes, higher taxes on packaged goods, pay-as-you-throw schemes, producer responsibility schemes, and higher waste (landfill) levies (JRC 2018; OECD 2019b). Regardless of whether such costs will be directly borne by the consumer or by the producer, **consumers may face higher prices on resource-intensive and "non-circular products", or even complete bans** as in the case of single-use plastics. Alternative, potentially new-developed "circular products" might also be expensive (depending on future policies and developments of new materials and products). Such a trend **could have negative distributional consequences**.
- On the other hand, a CE can also **lower costs for consumers in several ways: by providing more durable and repairable products, sharing services** (e.g. equipment rental, car sharing) and **better "secondary markets"**. Second-hand markets and rental / leasing business models will thus become important in order to avoid the development of a CE "for the rich" (EC 2019e).
- Sustainable consumption decisions require information, yet consumers do not typically have the time to undergo extensive research for every product they buy or **are burdened by a large amount of information (i.e. 'information overload'), sometimes leading to ambiguous conclusions.** This problem is independent of income differences; however, consumers with a lower level of education might have more difficulties coping with information overload. Moreover, consumers from lower income groups are likely to face a heightened mental burden. Thinking about what items to buy that can contribute to better resource efficiency or circularity supplements existing worries about the affordability of products (World Bank 2015). Furthermore, this pressure will become even more visible if the transition to a CE exacerbates existing income inequalities due to the demand for higher skilled jobs, as described in the previous sub-section.

3.3. Biodiversity, land-use and soil

The EU has committed to a headline target of halting and reversing the loss of **biodiversity and ecosystem services** by 2020 and to restore them so far as feasible. This commitment is supported by, among others, the 2020 Biodiversity Strategy (which requires "no net loss of biodiversity and ecosystem services", to be ensured, e.g. through compensation or offsetting schemes) – to be updated in the context of the EGD; the 2017 Action Plan for nature, people and the economy; and the

Green Infrastructure Strategy. Cornerstones of EU biodiversity legislation are the Birds and the Habitats Directives which protect animal and plant species, 200 habitat types, establish a European network of protected areas (Natura 2000) and require compensation for damage occurring there; a Regulation on Invasive Alien Species; and requirements on the authorisation and use of GMOs.

With regard to **land**, the EU follows the target of "no net land take by 2050". The present EU **Forest** Strategy (2014-2020) aims, among others, to protect forests and forest ecosystem services. The **Soil** Thematic Strategy aims for the protection and sustainable use of soil. Specifying this goal through a Soil Framework Directive met with Member State resistance in 2014, so no such Directive was adopted. The **Common Agricultural Policy** (CAP) to date provides only limited restrictions on degrading and incentives for more environmentally-friendly agricultural practices.

With specific relevance for **marine biodiversity**, the Marine Strategy Framework Directive (MSFD) aims to protect and preserve the marine environment and requires that EU marine waters have a good environmental status by 2020. The Common Fisheries Policy (CFP) includes catch limits to maintain fish stocks in the long term. For water policy in general, see Chapter 3.4 ("zero pollution").

3.3.1. Potential employment and regional economy impacts

- **Regulations, levies and infrastructural measures** (e.g. setting aside land or marine areas to protect nature, requiring biodiversity offsets, restricting or taxing activities that lead to a degradation of biodiversity, land, soils, fisheries and water) **increase the short-term production costs**[8] **in natural resource sectors** and, indirectly, in sectors using agricultural, forestry or fishery products. **This may affect the respective sectors' competitiveness and, indirectly, employment**. Increasing agricultural prices due to set-asides may (partially) compensate high land prices/rents.
- By maintaining the natural productivity of ecosystems and promoting the provisioning of ecosystem services, **said policies contribute to the medium- and long-term productivity** of resource-using sectors, thus **stabilizing or even increasing employment**. In the EU, 16% of total employment relies directly on ecosystem services, notably in sectors such as agriculture, forestry and fisheries; other sectors dependent on ecosystems include food, drink and tobacco, wood and paper, biofuels and renewable energy sources, the pharmaceutical industry, and environment-related tourism (ILO 2018b). Estimates based on an ILO model suggest that in a BAU scenario, productivity levels in 2030 would be 2.4% lower than today and 7.2% lower by 2050. This finding is seen to be in line with a number of studies assessing economic damages due to environmental degradation and loss of basic ecosystem services (ILO 2012a, vii).
- **Positive incentives** geared towards the sustainable use of the respective natural resources (e.g., agri-environmental schemes, payments for ecosystem services) on the one hand **increase the long-term productivity** of the resource-base and on the other hand **decrease short-term production costs**. They are thus conducive to **fostering sectoral competitiveness and employment**. ("Perverse" subsidies do so likewise, however, at the cost of the state of nature and thus inducing future costs to repair the damages, if these are not irreversible.)

[8] In the context of the (previous) CAP Reform 2020, the impact assessment concluded that greening measures could impact farm incomes by increasing costs, for instance due to the requirement to seed cover crops during winter time; by decreasing the level of production and revenue, for instance in the case of ecological set-aside; by impeding the shift to a more profitable production system, for example due to the "opportunity cost" of maintaining permanent pastures; by affecting individual production patterns in a way that leads to changes in the level of production which may have an impact on market prices, for instance in the case of ecological set-aside and crop diversification (EC 2011).

- The **creation of protected areas,** while reducing land available for agricultural or other production, **stimulates (forest) tourism with significant multiplier effects in other sectors**, such as agriculture, horticulture, transport and communications (ILO 2012a, p. 43).
- Stricter measures on biodiversity protection and land use may **limit revenues of non-ecosystem-dependent but high-impact sectors** such as pesticide production or – with regard to land use – mining and construction. However, **negative employment effects might be compensated by** job gains in other subsectors (alternative weed control, building and road renovation).
- Independent of impacts on the number of jobs, nature protection policies can affect the **quality of employment**. Limiting the use of chemicals (e.g., pesticides) hazardous to health increases job quality. Nature protection policies, however, do not necessarily lead to better wages or less occupational hazards and may not necessarily reduce the dependence of farmers on large agribusinesses that produce seed, chemical, and other technological inputs (Rosemberg 2017).

Beyond these generic potential impacts, we will look deeper into impacts in specific sectors.

A) Agriculture and agribusiness (including pesticide production & use)

- UNFCCC (2016) presents evidence from various countries which strongly suggests that **low-impact (organic) farming methods tend to be more labour-intensive** than conventional farming. It refers, among others, to research finding that organic farms in the UK provided 32% more jobs per farm than conventional agriculture (ILO 2012a; Worldwatch Institute 2011) and even 135% in another study (Morison et al. 2005). Based on a macroeconomic model simulating green investments in the agriculture sector globally, Herren et al. (2011) estimated the transition to sustainable agriculture to create over 200 million full-time jobs across the entire food production system by 2050. It has been pointed out, however, that to the extent that organic farms become established, and possibly larger, they may adopt labour-saving technologies, thus reducing their employment content (ILO 2012a, p. 26). ILO states that generally, in organic production, **higher returns** are related to lower costs on external inputs, such as synthetic fertilizers, together with similar or higher yields and premium prices (ILO 2012a, p. 25).
- Low-impact methods can also **improve working conditions**, particularly with regard to occupational safety and health (ILO 2012a, p. 19). ILO argues that strong investment in skills, rural infrastructure and organization would enable smallholder farmers to adopt greener and more productive farming practices that could not only boost food security but **lift tens of millions worldwide out of poverty and prevent accelerated rural-urban migration**.
- In the context of the (previous) CAP Reform (after 2013), the impact assessment concluded that, on average for the EU-27, **greening measures would decrease income per worker** by between -3.2% and -1.4%. The increase in market margin (market output minus intermediate consumption) would only partially compensate the estimated cost of the greening measures (around € 1,042 per farm on average), but the implementation of crop diversification and set-aside would indeed have an impact on the market by increasing agricultural prices. On average for the whole EU, the **market margin would increase slightly** (EC 2011, p. 29). However, **regional differences** were forecast: The market effect was expected to be positive for all Member States except the Netherlands, Denmark, Malta, Belgium, Cyprus and Portugal, due to their large shares of animal husbandry, in particular pigs and poultry, and fruits and vegetables production (ibid.).
- Looking at employment **effects of pesticide taxes** in Sweden and Denmark, a study finds that at the then-tax rates such effects were negligible, but that to the extent revenues were raised to fund advice schemes these induced some employment (ECOTEC et al. 2001). A more recent study by Lechenet et al. (2017) finds that total pesticide use could be reduced by 42% without any negative

effects on productivity or profitability in 59% of farms in the sample. This corresponded to an average reduction of 37, 47 and 60% of herbicide, fungicide and insecticide use, respectively. For attempts to reduce pesticide use though regulatory or tax measures this implies that **employment impacts would be unproblematic for farmers, while the (national-, EU-) markets for pesticide producers could indeed shrink**.

- A (case) study on the impacts of a **glyphosate ban** using the example of maize production finds that a ban would cause a shift towards more mechanical weed control but not toward more pronounced use of selective herbicides; the **ban would slightly reduce net profits and yields**, depending on output price levels and yield expectations (Böcker et al. 2019). These results contrast with a study which predicts that the absence of glyphosate would result in a decline in wheat yields in the UK of 12%, a fall in total cereal production of 15%, and in labour productivity of 10%. However, while the value contributed by farms is estimated to decline by £900 million, the changes in operations are predicted to result in an **additional labour demand** in the UK equivalent to a further 1,000 workers (Crop Protection Association & Anderson Center 2017).

B) Forestry

- FAO and UNECE describe **green jobs that would be increasingly needed in seven thematic areas related to the forest sector** (FAO & UN ECE 2018).[9] **Agroforestry** is assessed to be **one of the most cost-effective options for creating jobs** (ILO 2012a).
- Net employment gains from **afforestation and reforestation** depend largely on what land was previously used for and how productive the areas were (ILO 2012a, p. 45).
- **Forestry certification schemes promote decent working conditions.** However, in some instances they **can reduce the number of jobs** (in the short run) by limiting timber production. However, sustainable forestry practices **can increase productivity and economic growth and lead to more income** in the sector (ILO 2012a, p. 45-46).
- In the forest sector and forest-based industries (the latter constitute one of the largest industrial sectors in the EU), it is estimated that **for every job created in sustainable forestry, 0.68 jobs are created in other sectors of the economy**. This amounts to employment multipliers being about 10% higher for jobs created in the sustainable forestry segment than in the industry at large (GHK Consulting & Cambridge Econometrics 2007). ILO therefore holds that **more ambitious green growth strategies could result in even stronger net gains in employment**, by triggering a wave of new investment into the real economy (ILO 2012a, p. 42).

C) Fisheries

- Making fisheries sustainable requires a reduction of fishing pressure, among others through removing fishing capacity, reducing catch quotas, fighting bycatch, and reducing impact on marine biodiversity and soils. Such **measures partly bear a direct cost in themselves** (e.g., purchasing required monitoring equipment) **and partly cause opportunity costs** (idling vessels, fish not harvested). In a ceteris paribus scenario, such costs **translate into employment effects**.
- However, research shows that **overfishing – sometimes leading to irreversible fishery collapses – causes severe economic and job losses** (e.g., Scheld 2016). The significant decrease in employment in harvest fisheries in OECD countries is traced back to overfishing and increased mechanization (where capital replaces labour) (ILO 2012a, p. 65). Instead, **sustainable or recov-**

[9] Wood & Energy Production; Agroforestry & Mountain Forestry; Social & Urban Development; Forest Management, Inventory & Planning; Biodiversity & Ecosystem Functioning; Health & Recreation; Education & Research

ering fish stocks provide economic benefits and employment. For instance, North-East Atlantic bluefin tuna, which operates at a value of $90 million per year, could be worth some $600 million if it was more sustainably managed (ISU 2012).

3.3.2. Potential consumer impacts

- Potential consumer impacts relating to **food consumption** – such as **prices** adjustments in the case of meat and other food – are elaborated in the context of Chapter 3.1.2 on climate policy.
- **Environmental policies in the realm of land use, biodiversity and soils – leading to a more sustainable agriculture including less pesticide use – would have clear health benefits**. As the EEA writes, "Agriculture continues to be a major cause of poor water quality, with nutrients, pesticides, pathogenic microorganisms excreted by livestock and organic pollution from manure. Agricultural run-off carrying fertilisers, largely contributes to the eutrophication of fresh and marine waters" (EEA & JRC 2013, p. 51), with poor water quality posing risks to human health. The Global Environmental Outlook 6 reports that globally, water-related health costs are estimated at about $140 billion in lost earnings and $56 billion in health costs annually (UNEP 2019, xxix). Humans are now almost universally exposed to pesticides, many of which are harmful and even fatal at high doses; health effects of a chronic exposure to pesticides at lower doses are less clear (ibid, p. 221). A study looking at ammonia pollution linked to U.S. farming (fertilizer use plus livestock agriculture) finds that these emissions may impose human health costs greater than the profits earned by agricultural exports (Stokstad 2014).

3.4. "Zero pollution": clean air & water, safe chemicals & products

The European Commission's EGD Communication speaks of a "zero pollution ambition for a toxic-free environment", envisaging a "zero pollution action plan for air, water and soil" (EC 2019b).

The current EU's legislative framework for pollution prevention and control encompasses a wide range of directives and regulations. For all **waters**, the EU Water Framework Directive sets the overall objective of fulfilling a good environmental status. Further legislation supports its implementation.[10] The Marine Strategy Framework Directive (MSFD) specifically aims to protect and preserve the marine environment and requires that EU marine waters have a good environmental status by 2020, including though preventing and reducing inputs (chemical pollution, marine litter, etc.) into it.

When it comes to **air quality**, the most important pieces of legislation are the Ambient Air Quality (AAQ) Directive, setting air quality standards; and the National Emissions Ceilings (NEC) Directive, specifying national emissions reduction commitments for Member States. In addition, industrial pollution is directly addressed through the Industrial Emissions Directive (IED), the Directive limiting emissions of certain pollutants from medium combustion plants (MCP Directive), the Mercury Regulation on the use, storage, trade of mercury (including the management of mercury waste), and the Directive on the control of major accident hazards involving dangerous substances (the Seveso III Directive).

The **safety of products** due to hazardous chemicals is mainly regulated by the Registration, Evaluation, Authorisation, and Restriction of Chemicals (REACH) Regulation and by the Classification, Labelling, and Packaging (CLP) Regulation. While the former is to restrict or phase our chemicals of

[10] Groundwater Directive, Drinking Water Directive, Bathing Water Directive, Environmental Quality Standards Directive, Urban Waste Water Treatment Directive, Nitrates Directive, EU Floods Directive, etc.

concern, the latter shall ensure that consumers are aware of chemicals on the market. Other legislation on product safety includes the General Product Safety Directive and the Toy Safety Directive.

3.4.1. Potential employment and regional economy impacts

- The aim of pollution prevention and control initiatives is to **increase industrial efficiency, enhance environmental protection and improve workers' and public health at the same time.**
- Such regulation is often linked to employment loss. However, research on air quality regulation so far, mainly in the US, shows only **limited employment effects in polluting sectors**.[11]
- Moreover, one should **counterbalance the economic costs for some sectors with (avoided) costs for the impact of pollution on human health** (see section on consumers below).
- A similar outweighing of costs and benefits occurred in the impact assessment of the European chemicals regulation (REACH) proposal in 2003. It concluded that the costs for the industry (and the future Chemicals Agency) would total €5.2 bn over 15 years; meanwhile, the health benefits were estimated in the order of magnitude of €50 bn over a 30-year period (EC 2003).
- Apart from public health, pollution control and chemicals regulations can also specifically **improve workers' health and safety** (WHO 2011). Two studies have shown that **air quality is important for worker productivity** not only in the context of physically demanding jobs, but also for "white-collar" workers (Chang et al. 2016; He et al. 2019).
- Ash and Boyce (2018) argue that **workers' health benefits are even greater for disadvantaged communities.** They found that the share of exposure risk to pollution borne by blacks and Hispanics in the US generally exceeded their share of employment at the polluting facilities.
- **Anti-pollution policies can also lead to new jobs in green technology sectors**. As defined in a report by Ecorys (2012), the eco-industry produces goods and services to measure, prevent, limit, minimise, or correct environmental damage to water, air, and soil, as well as problems related to waste, noise, and ecosystems. According to the study, the total workforce employed by the eco-industry in the EU was about 2.7 million in 2008.

[11] To give an overview of some studies and their results:

- Berman and Bui (2001) demonstrated that the introduction of new regulation governing air quality in Los Angeles (hosting some of the country's most stringent air quality regulation) did not lead to a large decline in employment when compared to employment in Louisiana and Texas. The study argued that since all firms in a region were affected by the same regulation, they were still able to compete against one another while facing the same costs.
- Belova et al. (2013) found no evidence of large negative employment effects arising from the regulation of polluting industries in the US (including petroleum, plastics, pulp and paper, and iron and steel), analysed over a 30-year period). Furthermore, the study did not find a significant impact of regulation on plant exit probabilities.
- Another study looked at the effects of the US Clean Air Act and found that regulation may have led to a loss of 40,000 jobs in parts of the country that had "dirty" air (Greenstone 2002).
- Dechezleprêtre and Sato (2017) concluded that ambitious environmental policies (to a large extent focused on pollution) can lead to small, statistically significant adverse effects on trade, employment, plant location, and productivity in the short run, particularly in pollution- and energy-intensive sectors, but that the scale of these impacts is small compared to other determinants of trade and investment location choices. However, the study concludes that pollution leakage remains a major risk for basic industrial sectors characterised by very energy-intensive production processes, limited ability to pass pollution abatement costs to consumers, and a lack of innovation and investment capacity.
- Finally, Walker (2013) showed that relocation (prompted by the Clean Air Act) left workers with an earnings loss equivalent to 20% of their pre-regulated earnings, amounting to $5.4 bn in lost earnings.

3.4.2. Potential consumer impacts

- Since air pollutants (e.g. particulate matter, sulphur dioxide, nitrogen oxides) directly harm human health, their avoidance through regulation **brings huge public health benefits and reduces potential health costs**. In 2013, the EC estimated the total health-related external costs of air pollution to be between €330 bn and €940 bn per year in the EU.
- The EEA (2018b) found that **groups of lower socio-economic status** (i.e. the unemployed, those on low incomes or with lower levels of education) **tend to be more negatively affected by environmental health hazards** (such as air pollution and noise), as a result of both their greater exposure and higher vulnerability. The same study found pronounced regional differences in social vulnerability and exposure to environmental health hazards across Europe – with **poorer regions facing higher levels of exposure**.
- A recent study by COWI and Eunomia (2019) calculated the **costs associated with the implementation gaps of environmental law**. The study found that the costs of not fully implementing air quality targets reached €8.7 bn to €40.4 bn per year (for the EU urban population exposed to air pollution above the AAQ Directive concentration values). Implementation gaps in the water sector reached €4.3 bn to €14.3 bn; and implementation gaps of environmental law related to industrial emissions and major hazards were estimated at €3 bn to €4.4 bn.
- ICL (2019) shed light on the extreme severity of health hazards related to air pollution, citing various sources that have estimated the number of deaths resulting from air pollution in the UK. PM and NOx contribute to around 40,000 **air-pollution-related deaths** per year in the UK, with 60% of deaths related to the combustion of fossil fuels caused by the transport sector.
- Similarly, the global ecosystem costs of **marine plastic pollution** were recently estimated to reach $3,300–$33,000 per tonne of marine plastic per year (Beaumont et al. 2019). This reduction in ecosystem service provision was evidenced to have implications for human health and well-being, linked particularly to **fisheries, heritage and charismatic species, and recreation**.
- The Drinking Water Directive regulates the quality of water intended for human consumption. An evaluation estimated the total annual cost for supplying drinking water in the EU in 2015 at roughly € 46.3 billion, of which 8.3 billion can be attributed to the implementation of the Directive, slightly rising in the future. However, **safe drinking water is essential for public health and well-being; defects in quality could cause high social and economic costs** (EC 2018d).
- Policies to reduce accumulation of nitrate (and phosphor) in groundwater can **limit costs for suppliers of drinking water and thus prices for consumers** (Oelmann et al. 2017).
- However, taxing or regulating pollution can, in principle, also lead to **higher prices or restrictions** for consumers. For example, **low-emission zones and bans of (old) high-emission cars in urban transport pose challenges for consumers** – especially, if the public transport system is not well developed. In addition, such policies might **especially affect low-income households** that often live in the periphery of a city and might not be able to afford a new low-emission car.
- The EU **REACH Regulation has successfully contributed to protecting consumers** by restricting and banning harmful substances. However, producers often replace them with substances which **might expose consumers to new risks** (CHEMTrust 2018; Warhurst 2015).

4. Possible measures for mitigating negative effects

Based on the systematic analysis of possible social impacts from environmental policy, this chapter looks at possible solutions to mitigate negative and social bias effects – without sacrificing environmental (transition) goals. We do not develop individual policy-options in depth but give an overview of different types of measures which should be considered in the governance of transitions, within and beyond the realm of environmental policy.

It is important to note that there is no "one-size-fits-all" solution. As the ILO (2015) writes: "Policies and programmes need to be designed in line with the specific conditions of countries, including their stage of development, economic sectors and types and sizes of enterprises".

The chapter is based on a review of literature, from where we have also extracted some best/good practice examples from EU Member States. As there are few examples of completed just sustainability transitions, good practice cases usually refer to rather specific measures.

4.1. General procedural measures

4.1.1. Allowing for time to adjust – but starting early

- In general, businesses, workers, consumers and communities need **some time to adjust** with regard to new business models, employment opportunities or lifestyles.
- However, given the imperative of ambitious and rapid climate change mitigation action, "the window of opportunity for gradualism" is shrinking (Gambhir et al. 2018). Therefore, the **necessary change** (not only with regard to climate change) **needs to be identified and remedying political action needs to be started as early as possible**. As analyses of past maritime industry and coal transitions show, the earlier that actors have anticipated, accepted and implemented steps to prepare and cushion transition shocks, the better the results (Caldecott et al. 2017; Heyen et al. forthcoming; Keltaniemi et al. 2013). Delay in adequate action will result in further (carbon) lock-in and stranded assets, and more change will need to happen on a compressed timescale, thus increasing the severity of impacts on affected business, workers and regions (UNFCCC 2016).
- **Concrete timelines with clear, consistent middle- and long-term goals (also on sector level) give planning and investment security** to industries, workers and consumers as well as Member States, regions and local communities. Timely planning prepares them to make decisions where investments risk becoming stranded, where opportunities from economic modernisation might arise or on employment and technology choices. For instance, the difference between 80% and 95% emissions reductions has large implications for the fossil gas sector (Popp & Fischer 2019).
- Clear medium- and long-term goals, together with measures that allow for some time to adapt, **also avoid legal compensation claims** by companies and consumers (Heyen 2017).
- The **ambition-level of policy instruments** (e.g. the level of resource / carbon taxes, or standards and restrictions) **may also be increased over time** (similar to the ratchet mechanism in the Paris Agreement). Starting with lower ambition-levels when a new policy is introduced might encourage their political feasibility, but stringent increases in ambition are required for subsequent years. Again, future steps should be determined and communicated from the beginning so that the instruments' target groups can adapt in a timely manner.

4.1.2. Social & regional dialogue

- Given the scope of societal impacts of sustainability transitions, **inclusive social dialogue** is another key governance element (DG EMPL 2019). In its narrow definition, social dialogue means consultations and negotiations between **governments, employers' and workers' associations** on economic and social policy (so-called "tripartism") (ILO 2012a). In the case of sustainability transitions, dialogue should be thematically broader and should also include **environmental, consumer and other NGOs as well as representatives from particularly affected communities**.
- Social dialogue can contribute to raising awareness and acceptance; informing national systems and institutions about implications for qualifications, employment and consumers; and to finding specific solutions for affected groups (ILO 2012a). Studies show that transition strategies on which a relative consensus had been reached performed better historically – they showed greater political resilience and a more coherent and comprehensive approach (Gambhir 2018; Botta 2018). This does not mean that individual policy measures are widely agreed on, but a consensus is required that the sector needs to adjust (Wehnert et al. 2018).
- The ILO Just Transition Guidelines state: "Strong social consensus on the goal and pathways to sustainability is fundamental". Governments should, inter alia:
  - "(a) actively promote and engage in social dialogue, at all stages from policy design to implementation and evaluation and at all levels from national to enterprise level in line with applicable international labour standards most relevant to the just transition framework, to forge consensus on pathways towards environmental sustainability with decent work;
  - (b) promote the creation, development and formalization of dialogue mechanisms and structures at all levels to discuss the best means to implement national social, economic and environmental goals"
  - and also foster social dialogue at the sectoral level (ILO 2015).

Good practice: The German multi-stakeholder commission on a phase-out of coal

National high-level and multi-stakeholder roundtables on sustainable development (policies) have been created in several EU Member States (including France and Spain). The recent commission on the future of coal in Germany is a good example of the initial attempt to seek a broad societal consensus on a highly controversial topic: the phase-out of lignite mining and of any coal-based energy production.

The commission, officially called the "Commission on Growth, Structural Change and Employment", was established in June 2018 by the German Government. It brought together key stakeholders from industry, trade unions, coal regions, environmental NGOs, research institutes and communities at risk by the expansion of coal mines. They were tasked with developing common recommendations for a timeline for reducing and finally phasing-out coal energy production, considering the official climate goals in the energy sector as well energy prices for industries and consumers, and public support for the transition in the coal regions.

A hard-fought compromise between the members of the commission was reached in January 2019 to phase-out coal by 2038 at the latest. The compromise was welcomed or at least accepted by an overwhelming majority of political parties and societal interest groups (including most environmental NGOs).

However, the phase-out law finally proposed by the Government in January 2020 partly deviated from the commissions' recommendations. This caused wide criticism from climate research and activists and their representatives in the commission and impaired the overall reception of the commission's usefulness.

➔ *For more information and a critical reflection see*: Reitzenstein & Popp (2019)

4.2. Measures to mitigate negative effects on workers & regions

As Chapter 3 has shown, ambitious climate and other environmental policies usually have (or are expected to have) a positive net employment effect. Still, they are likely to disrupt carbon- or resource-intensive sectors, negatively affecting businesses, workers and regions.

To tackle negative impacts, one can generally distinguish between defensive and rather short-term measures (e.g. compensation for losses) and more active, forward-looking and "holistic" (including non-financial) measures aimed at structural reorientation (Green 2018; Spencer et al. 2018).

Since the German Ruhr region is an often-cited example of a relatively successful transition, combining a large range of measures, we describe it in more detail in the following text box.

Good practice – Restructuring of Germany's Ruhr region

The Ruhr region experienced a transition from a coal and steel-based economy to a knowledge-based and service-oriented economy. Although the transition was not primarily driven by environmental concerns, the lessons learned also provide valuable insights for future sustainability transitions (UNFCCC 2016).

At the sector's peak in 1956, almost half a million people were employed in the coal mines of the Ruhr, producing about 124 million tons of coal (Campbell & Coenen 2017). Over the period 1957-2013, employment in the mining industry had been radically downsized, from 473,000 to 11,448 workers. At the same time, iron and steel employment also declined by up to 80% (Galgóczi 2018; Gambhir et al. 2018). In 2018, the last coal mine (Prosper Haniel in Bottrop) closed, bringing an end to an entire epoch.

Responding to the risk of rising unemployment, measures have been taken up, partly funded by the EU. They included early retirement packages, compensation payments, wage subsidies, worker retraining and development programmes (EEA 2019b). Based on existing and future skills demands, model projects were set up and individual re-employment strategies were developed with the help of personnel development centres and agencies such as the Ruhr Coal Vocational Training Society (Galgóczi 2018; UNFCCC 2016).

In order to shore up industries, public authorities supported existing firms in starting a diversification process in the mid-1980s, promoting proactive industrial policies (EEA 2019b). New innovations, e.g. in the field of environmental technologies, such as renewable energy, energy efficiency, recycling and waste combustion, brought fresh impetus into the region. The regional diversification strategy succeeded in making the Ruhr area one of today's key centres for environmental industry, technology and research in Germany, employing some 100,000 people in these sectors by the mid-2000s. The Emscher Park International Building Exhibition (IBA), the Gelsenkirchen Science Park and Innovation City Bottrop are successful outcomes of these investments (Shaw 2002; UNFCCC 2016). Moreover, some former industrial areas have transformed into tourism and cultural hot spots. "Zeche Zollverein", once the world's largest coal mining site, for instance, became a UNESCO World Heritage Site and includes a museum on regional artefacts.

Restructuring strategies were elaborated in collaboration between different stakeholders. Social dialogue, partnerships between municipalities, universities and private actors as well as the cooperation between trade unions and regional governments enabled the integration of a broad exchange of interests and perspectives. In 1993, a comprehensive agreement guaranteeing social responsibility during the restructuring process was signed by relevant parties. In 2007, a consensus agreement between Federal and regional Governments together with the coal industry association and the trade union laid the foundation for phasing out hard coal mining subsidies, thus closing the last coal mine by the end of 2018 (Heyen 2011).

➔ *For more information see:* Galgóczi (2014)

4.2.1. Supporting affected companies (and farmers) to adapt / change

- On a structural level, **national tax reforms increasing taxes and duties on resource consumption and emissions while at the same time (and to the same extent) decreasing the tax and duty burdens on the production factor of labour (incidental wage costs)** creates incentives and relief for companies to adjust their business models in an environmental-friendly way without

increasing the overall tax burden. “If properly designed, such a tax shift can boost overall employment creation, as well as investment and innovation in environmentally friendly technologies” (ILO 2012a), also called a “double dividend” (Patuelli et al. 2005). To the extent that the tax recycling benefits the social security systems, this policy also supports workers (De Miguel et al. 2015).

- Companies affected by ambitious environmental transition policies can be given **advice, R&D subsidies and/or investment aid (grants, favourable loans) related to restructuring, greener technologies and new green business models**. They require respecting public aid rules.
- **Small- and medium-sized enterprises (SMEs)**, accounting for more than two-thirds of permanent employment, **might need special assistance** to “successfully navigate the shift to a greener economy and to seize its opportunities” (ILO 2012a) since they tend to be less diversified and less well equipped with human, financial and knowledge resources.
- For a sustainable transition of the agricultural sector, a combination of a **reform of agricultural subsidies towards remuneration of environmental services and training on more environmentally-friendly practices** (especially for small-scale farmers) is needed (UNFCCC 2016).
- **Direct compensation of companies should in general be avoided**, if possible, since it could cause a chain reaction of compensation claims or windfall profits and false incentives. For example, a company might let a plant, which was going to be shut down anyway, run until it receives compensation through a government-imposed phase-out. **In some cases, compensation might be appropriate or even constitutionally required**, such as when a quick technology phase-out is necessary. If compensation is given, it should be conditionally linked to companies’ investment in new business models (Heyen 2017).
- To protect business in globalised markets against unfair competition from less-stringently regulated countries and to avoid carbon leakage, **border tax adjustments** can be an option until ambitious climate and environmental policies are imposed more universally (Gambhir et al. 2018).

Good practice: Örnsköldsvik (Sweden)

The transformation of a pulp and paper plant into a biorefinery in Örnsköldsvik, a locality on the east coast of Sweden, is a good example of a successful transition of a region that once was at the risk of losing its main employer. In 1996, the Swedish pulp and paper giant, MoDo, was about to shut down its plant, directly threatening approximately 400 jobs plus further jobs with local suppliers (Novotny & Nuur 2013). The absolute decline in global demand for traditional paper products, the increasing competition from fast-growing eucalyptus species from North and South America and the intensification of environmental legislation with taxes on waste disposal had brought the paper production to the limits of economic viability.

However, in 2000, a consortium of private investors supported by local trade unions, the municipality and the mill management acquired the plant and transformed it into a biorefinery. In 2013, the plant became Sweden's largest industrial biogas producer (Dominguez Lacasa et al. 2018). This would not have been possible without the engagement of the local government ensuring the evolution of the plant at the right time, i.e. when renewable energy became a paramount policy strategy (Novotny & Nuur 2013).

➔ *For more information see*: Novotny & Nuur (2013)

4.2.2. Supporting affected workers

- **Workers in declining industries should be supported in finding new jobs**. There is an “active but largely familiar role for labour market and skill policies” (OECD 2012). Basic measures to facilitate re-employment include **job placement services, job search training, assistance for relocation, recruitment incentives for companies, and support for business formation**.

- In the case of sectoral restructuring, however, the **re-/upskilling for new (green) technologies is key**. Against the backdrop of a general lack of investment in training (PWC 2019) and a particularly fast increase in skill requirements for a Green Economy (DG EMPL 2019), in order to meet the skill demands of the future, more investment in education and training is needed, and improved awareness about opportunities and shifts in the labour market (ibid.).
- The ILO Just Transition Guidelines recommend that governments, in consultation with social partners, should, inter alia:
  - **coordinate skills development policies and technical and vocational education and training systems with environmental policies and the greening of the economy**; and consider concluding bipartite or tripartite agreements on skills' development;
  - match supply and demand for skills through **skills needs assessments**, labour market information and core skills development, in collaboration with industry and training institutions;
  - give high policy priority and allocate resources to the **identification and anticipation of evolving skills needs and the review and alignment of occupational skills profiles and training programmes** (ILO 2015).
- Government resources should be combined with the hands-on knowledge about relevant skills and circumstances of employers' associations and trade unions (UNFCCC 2016).
- In the light of diversity between regional and local labour markets, national schemes should allow **some autonomy for subnational governments to customize their programmes** (Botta 2018).
- Financial incentives can expand the scope of training provided by employers (ILO 2018a).
- The **skill sets of jobs in "brown" industries are often transferable and adaptable to low-carbon sectors**. For example, skills in the oil and gas industry can be used for off-shore wind, skills in petroleum drilling technologies for the geothermal sector, skills in the traditional construction sector for retrofitting of buildings (Botta 2018; UNFCCC 2016).
- **Since older workers experience particular difficulties in finding new employment, specifically-targeted labour market policies are appropriate** (Botta 2018, referring to OECD studies). A key priority is providing adequate retraining for older workers since training is often mainly targeted on younger people. Information campaigns can help to remove the negative perceptions of age, such as by the Polish "The Benefits of Maturity project" (ibid.).
- While money is better spent on re-skilling than on lump-sum **redundancy payments** (Botta 2018; Caldecott et al. 2017), the latter is also necessary when people experience difficulties in finding a new job. Older workers might also benefit from **early retirement schemes**.
- Regarding financing, governments should articulate long-term financing needs and **establish sustainable funding mechanisms** for the implementation of these measures (ILO 2018a).

Good practices: Reskilling workers in different Member States

- The French Observatory for Green Economy Jobs and Skills (*Observatoire national des emplois et métiers de l'économie verte*) has been established in line with the National Transition Strategy Towards a Green Economy. The Observatory is tasked with monitoring the sectoral and macroeconomic impact of the green transition, with special attention to its implications for jobs and skills (Botta 2018).
- The Oil & Gas Workforce Plan by the UK Government underlines how the skills of oil and gas workers can be applied in numerous other industries. A platform "Skills Connect" is intended to help displaced workers to identify occupations in other sectors that require a similar set of competencies and relevant technical training. In addition, a dedicated online platform will allow companies interested in recruiting former oil and gas industry employees to have direct access to individual profiles (Botta 2018).

- The Flemish public employment service has developed a "sustainable building" competency centre in East Flanders. In addition to practical skills training, like learning how to build eco-efficient heating, the centre also intends to match workers and engineers to demand in the construction sector (ILO 2012a).
- In France, the region of Aquitaine provided funding for upgrading the skills of those in traditional automotive industry occupations (e.g. electricians and welders) to be able to take up employment related to wind-turbine production (ILO 2012a).
- In Spain, the regional government of Navarra managed to convert the region from a traditional car manufacturer into Europe's sixth largest producer of wind power, and to create and provide training for over 6,000 jobs in this sector (ILO 2012a).
- Following Romania's decision to close two uncompetitive coal mining units by 2018, financial support totalling 54 million euros has been earmarked to provide income support to workers who become unemployed and to retrain former employees so they can find jobs in more sustainable sectors (ILO 2018a).

4.2.3. Supporting new businesses and decent work conditions therein

- Governments should facilitate and support the creation of new green business models and green firms by appropriate framework conditions. Appropriate measures are:
  - **Promoting entrepreneurship with consultancy, easier procedures, start-up grants and R&D subsidies** specifically for green business ideas
  - **Changing the regulatory framework in a way (e.g. by standards or an environmental tax reform, see above) that makes green investments and business models attractive**
  - **Investing in high-quality (public) infrastructure that is necessary for a Green Economy** (e.g. public transport, energy grid and storage infrastructure, charging infrastructure for electric vehicles, communication and data exchange infrastructure).
- Attention should be paid to the working conditions in new business sectors. National policies designed to green the economy tend to focus mainly on job growth and do not take sufficient account of whether or not the green jobs are decent (ILO 2012b). Government measures to encourage the shift to a greener economy should, together with social partners, be attached to strict clauses **protecting the rights to freedom of association and to bargain collectively and ensuring decent minimum conditions for workers** (ibid.).
- Special attention should be paid so that a Green Economy creates **equal working opportunities for women**. Initiatives to increase female participation in traditionally male-dominated (green) fields should build on multiple levers, including attracting women towards STEM (Science, technology, engineering and maths) education, connecting women with role models and mentors, providing opportunities for scholarships for both academic and industry research (IRENA 2013). Several countries (including Finland, Italy, and Sweden) have participated in a Clean Energy Education and Empowerment Initiative to encourage women to seek careers in clean energy.
- In addition to supporting new businesses, it is necessary to keep existing (viable) green companies in business that have difficulties to secure a company successor (e.g., family businesses). Existing public policies (subsidised loans etc.) for **supporting company succession** need to be applied particularly to businesses in the environmental sector, including organic agriculture.

Good practice: Denmark's transition from coal to wind

Denmark's transition from coal to wind energy is a good example of successful (industrial) policy making, resulting from a combination of job, innovation and investment promotion in the wind sector (JTC 2017).

In 1990, coal was responsible for 85% of electricity production in Denmark. However, during the time period 1994-2015 Denmark succeeded in reducing its coal use by 50%, while its total share of wind energy increased by 40-50% (Rosemberg 2017). Companies such as Vestas, one of the world's largest wind turbine

manufacturers, as well as Ørsted (former Dong Energy) have been attracted to the region, generating new jobs. In 2018, more than 31,000 people were directly employed in Denmark's wind sector.[12]

The transition was only possible due to the strong commitment of Danish unions. These play an important political role in the country and promote green industries as the country's greatest chance for new job creation (JTC 2017). In 2014, Denmark's largest trade union "United Federation of Danish Workers" (3F) even established a green think tank, calling for more ambition on climate and energy targets, and assessing the implications of new climate policy initiatives for the creation of decent jobs (3F 2015).

Moreover, the Danish Pension Funds System enables profitable investments in renewable energy projects, mostly offshore wind parks. Investing money from pension funds in domestic wind projects not only fosters domestic companies but also helps to sustain local jobs (JTC 2017).

4.2.4. Supporting regions & communities

- If a declining sector is geographically concentrated and has played an important role for regional economies and local communities, special attention is required. To avoid a spiral of declining municipal budgets and public spending on local infrastructure, these **regions and communities should be supported in a timely manner by higher political levels** (Heyen et al. 2017).
- National governments can **increase spending on the regions' infrastructures (transport, education, communication, leisure), might locate (new) public institutions in the regions and can incentivise business to invest there via grants or tax incentives** (Caldecott et al. 2017). The focus should then be on sustainable industries, taking into account endogenous regional potentials and location factors. This may involve renewable energies in connection with new storage technologies, efficiency technologies or IT-based business models. In the case of lignite regions, "post-mining" competencies and business models are also available that could be used for future coal exits abroad in a similar way to nuclear power plant decommissioning (Heyen et al. 2017).
- A better focus of existing economic support programmes, e.g. the European structural funds, on sustainable transitions offers a potential source of funding. For particularly profound transition processes, special European or national funding programmes could be developed.
- Top-down financial support should be coupled with **bottom-up processes for the development of visions and ideas for the region's future and some autonomy on spending**, with strong participation of local business (including start-ups), research and civil society. Again, the German Ruhr Region provides an example with its organisation "Innovationsregion Rheinland".
- Moreover, **research and education institutions** are an important success factor for regional structural change. In cooperation with companies, they ensure the availability of know-how and the ability to innovate in a region. Since research institutions tend to orient themselves to the needs of the region's dominant industry, in case of a declining industry **economic diversification also requires diversification of research** in a region (Heyen et al. forthcoming; Koschatzky 2018).

Good practice: From shipbuilding to a science park: Gothenburg (Sweden)

Gothenburg is an industrial centre on Sweden's west coast and the country's second largest city (population 500,000). Lindholmen was the site of Gothenburg's shipyards where some 15,000 people worked until the 1970s, when foreign competition and the effects of the oil crisis led to their closure (Cadell et al. 2008). The yards were nationalised and phased down in an orderly way. Redundancies were avoided through the creation of new jobs, retraining, redeployment or early retirement. One of the first measures was to convert the Lindholmen shipyard into a training centre to retrain the city's unemployed shipbuilders.

The City of Gothenburg took responsibility for Lindholmen in the early 1990s and a proactive city-owned development agency began to create a stylish mixed-use quarter, including six secondary schools.

[12] See https://en.winddenmark.dk/wind-in-denmark/statistics/employment-export-and-revenue

Chalmers University of Technology established an engineering programme at Lindholmen. At least 24,000 people work, study or live at Lindholmen today, and about 375 companies are based in the area.[13]

What makes the scheme special is the way in which the Council, universities and leading companies worked together to create a cluster of knowledge-intensive firms (Cadell et al. 2008).

4.3. Measures to mitigate negative effects on consumers

As Chapter 3 shows, climate and other environmental policies usually have large public health benefits (including avoidance of health costs). However, sustainable transitions might sometimes bring new negative consequences. Above all, consumers, and disproportionally low-income households, might be affected by rising prices for carbon- and resource-intensive commodities.

For normative and acceptance reasons, policymakers should take into account these effects and seek ways to mitigate conflicts between environmental and social goals.

With regard to energy poverty, a distinction can be drawn between long-term policies to address the root causes of energy poverty (generic social and economic policies, policies concerning the energy performance of buildings and heating technology) and policies designed to ease the burden on households in the short term (tariff reductions, benefits, subsidies) (Schumacher et al. 2015). However, there is no simple solution that addresses all target groups, provides short- and long-term aid and incentives, reduces or avoids poverty in socio-political terms and contributes to the achievement of energy and climate policy goals (Cludius et al. 2018).

4.3.1. Supporting consumers in saving resources and money

Many energy efficiency and other sustainable consumption measures can save environmental resources as well as consumers' expenditure. Their potential can be exploited by the following kinds of policy measures:

- A basic approach is **information and awareness raising on saving potentials** – from general education to household-specific audits on electricity, heating and water; including technological and behavioural options. At least low-income households should receive such advice free of charge. These measures tend to be quite successful in reaching households (EPO n.d.).
- There should be **permanent financial support programmes for replacing inefficient with energy-efficient heating systems and household appliances**.
- Of particular importance is support for the **energy-efficient renovation of buildings**, combined with regulatory mechanisms to **ensure energy bill savings for tenants are not overcompensated by higher rents** due to an excessive apportionment of the renovation costs onto rents.
- With regard to mobility, support for **convenient and affordable public transport and shared mobility systems** (as well as convenient cycling infrastructures) can reduce negative impacts of rising fuel prices and improve the social inclusion of low-income households. Enhanced connections between rural and urban areas could also help mitigate growing regional disparities.
- In general, high-qualtiy **sharing and rental / leasing services as well as financially attractive repair services and secondary (second-hand) markets** can reduce environmental impacts as well as consumer costs. Regulatory framework conditions (also financial if necessary, as in the case of labour-intensive repair services) should be improved to make them more attractive.

[13] See https://www.lindholmen.se/en/about-us/history

- **Consumers should generally be made more aware of the fact that not only more efficient appliances but also "sufficiency behaviour" can reduce costs** (Fischer & Grießhammer 2013). Apart from buying second-hand or travelling by bike, food consumption is another example: while an average diet based on organic food is about 30% more expensive than based on conventional food in Germany, the switch to an organic less-meat diet as recommended by health organisation would bring additional costs of only 3% or €80 per year (Teufel et al. 2014).
- **Policy instruments can support "sufficiency behaviour"**. For example, if energy labelling for household appliances or cars has a **stronger focus on absolute consumption levels** (instead of size-dependent efficiency), more consumers would potentially buy smaller appliances and cars, saving money and resources. Another example are progressive taxes, e.g. on energy consumption or cars: the larger the product or consumption, the higher the tax (Heyen et al. 2013).

4.3.2. Additionally protecting vulnerable households from energy poverty

In order to particularly protect low-income and other vulnerable households from rising prices (especially for energy- or carbon-intensive products), a range of additional measures is available – apart from the above-mentioned support of energy saving measures:

- The most fundamental approach would be to **address the root causes of poverty**, e.g. stagnant or falling incomes, regressive distribution policies, precarious employment, inadequate pensions and social security benefits, or rising rents (Strünck 2017).
- **Carbon or other environmental tax revenues could be handed back** to all or only vulnerable households (called "revenue recycling"). Households which consume little energy at home and rarely use cars and flights would be financially better off. While using revenues for tax cuts might mainly benefit high- and middle-income households, **the return of a lump-sum per person to all or vulnerable households (or an investment in public transport, for example) would have progressive instead of regressive effects** (Agora Verkehrswende & Agora Energiewende 2019; Büchs et al. 2011; Doranova et al. 2018; Eliasson & Mattsson 2006; OECD 2017).
- **For people who receive social security benefits, including energy bill support, these payments should be raised to cover increased costs. Alternatively, energy bills can be directly paid by the government**, as is done with heating costs in Germany. The advantage of the first option is that it still includes a financial incentive to save energy which is not the case with the second option if no adequate cost limit is set. The disadvantage of the first option is that a uniform sum for energy neglects the needs of specific types of households. Elderly people, disabled persons, families with young children and usually people in poorly insulated buildings require more space heating compared to the average household (OECD 2014). A limitation to both options is that there may still be vulnerable groups that have to pay for their heating energy, especially those groups that are just above the transfer threshold (Cludius et al. 2018).
- An alternative to financial support is the **legal obligation on energy (or public transport) suppliers to offer discounted "social tariffs"** for vulnerable households. Another regulatory option is to **prohibit disconnection of indebted households from electricity and heating**, especially during wintertime (EPO n.d.). A caveat is that both options do not tackle the root causes of energy poverty and do not provide an incentive for energy saving (Schumacher et al. 2015).
- A **basic energy allowance for all consumers** which has a lower price per kilowatt hour, is tax-free, or is included in the basic rate, could assure broad access to a minimum demand for energy (SRU 2016). Above the basic contingent, there would still be an incentive to save energy.

Since most of these measures do not provide saving incentives, a combination with energy-saving measures is important (see above).

Good practice: "Habiter Mieux" in France

The "Habiter Mieux" programme in France financially supports low-income homeowners to renovate their home. Between 2011 and 2017, programme has supported a total of 250,000 households in an energetic refurbishment; from 2018, 75,000 more households shall be added annually.

For a household to be eligible, at least 25% energy savings must be possible, and income also plays a role in support. 45% of the subsidized households live below the poverty line. Anyone living in a 15-year-old home can receive 35-50% of the costs for energy-efficient renovation up to an upper limit of € 12,000.[14]

In order to effectively reach energy poor households and account for regional disparity, France has granted departmental authorities freedom in their methodology for identifying target areas and households and for implementing programmes. This enables tailored approaches to data availability, networks and methods and improves the overall efficiency and effectiveness of the programme (Schumacher et al. 2015). To reach the target group, social workers and even postmen are mobilised (see oeko.de link above).

The scheme is accompanied by excellent monitoring, with specialised surveys. More than half of the concerned inhabitants state financial savings, and the vast majority (82%) reports that they do not feel cold anymore during the winter (Schumacher et al. 2015).

Good Practice: "Stromsparcheck" in Germany

The "Stromsparcheck" is an advice and consultancy service to low-income households offered by Caritas and the Federal Association of Energy Agencies and funded by the Federal Ministry for the Environment.

This instrument addresses electricity as well as efficient heating energy use. It consists of two modules: On the one hand, it provides energy-saving consultation towards replacement and behavioural changes. On the other hand, it provides certain high-efficiency devices free of charge, directly enabling energy savings.

The programme has been evaluated to be very effective. It also provides an employment stimulus as long-term unemployed people are trained and involved as energy counsellors (Schumacher et al. 2015).

➔ *For more information on these and many other Member State measures against energy poverty see*: Schumacher et al. (2015); Cludius et al. (2018)

4.3.3. Avoiding new burdens and risks and their unfair distribution

- Green technology factories, renewable energy installations or (circular) waste management sites may involve impairments for local communities. **Measures should thus be taken to avoid such impairments, for example by ambitious emission and noise standards**.
- **Local communities should be closely involved through participation and consultation and should also benefit through jobs, tax revenues and/or financial participation.**
- **Care should be taken by producers and regulators that hazardous substances are not replaced by other substances posing risks** in sourcing, processing or use in products.
- **Care should also be taken that recycling and secondary markets do not pose risks to consumers with regard to recycling of hazardous substances or product quality**.
- Pollution and prevention measures could burden small-scale farmers that may lack the know-how (and/or capital) to improve their production processes. Guidance and information on alternatives could be offered through the local municipality (for example).

[14] See https://www.oeko.de/e-paper/die-soziale-seite-der-energiewende/artikel/besser-wohnen/

5. Recommendations for future EU policy

Based on the analysis in Chapter 3 and the range of possible solutions in Chapter 4, this final section presents some recommendations for future EU policy. It is important to acknowledge that the EU has limited competencies in some of the policy fields that play a key role in enabling a Just Transition, especially tax, employment and social policy.

As said at the beginning, this study was drafted in view of preparing for an 8th Environment Action Programme (EAP), as the 7th EAP expires at the end of 2020. Its main added value is not in the level of detail relating to specific recommendations, but in its holistic approach looking at a broad range of areas and target groups, with a view to identify possible future work strands.

5.1. General recommendations

- **Ambitious, clear, consistent and ideally quantitative targets for the medium and long term** at EU and national levels will increase planning security. Setting the goal of carbon neutrality in 2050 is a good example. Goals should be set and, if needed, adjusted (e.g. the 2030 carbon reduction goals) as early as possible according to the best available knowledge. Medium- and long-term goals should, as far as possible, also be set **for other areas than climate**, e.g. resource consumption and the Circular Economy, "zero pollution", or biodiversity.
- **Detailing targets on a sector level** (e.g. mobility, agriculture) could further increase planning security and help avoiding that sectors dump the responsibility to each other**.**
- **Inclusive social dialogue** should take place to translate these goals into **sectoral and regional roadmaps** and policies for a Just Transition. This can build on the work started in the context of the European Climate Pact. The approach of regional plans and strong stakeholder involvement used in the context of the Just Transition Fund could be considered also for other sectors.
- Such an inclusive approach also needs **strong vertical and horizontal cooperation between all governance levels (EU, national, regional, local), and at each level also between different governmental departments** (especially between economic, employment, consumer protection and environmental departments). A range of ideas have been developed on such cooperation and integration since the EU's Cardiff Process; best practice should be identified and implemented.
- The **EU budget should be strongly oriented and aligned towards sustainable development and the support of sustainable transitions**. While a special Just Transition Fund will help, it is of at least equal importance that current funds, especially on regional development and cohesion, are aligned with the European Green Deal (see also Section 5.2).
- The EU should continue to **encourage Member States to undertake environmental tax reforms,** taxing resource use and emissions (not covered in the ETS) while using revenues to lower payroll taxes and incidental wage costs, hand back lump sums to (vulnerable) consumers and finance their own national transition funds. Regarding consumption taxes, a **stronger emphasis on direct paybacks** (for vulnerable households) could raise their public acceptance.
- As envisaged in the Better Regulation Guidelines, **all measures in the context of the European Green Deal should be assessed, monitored and evaluated, paying attention to all kind of social effects** (cf. Section 2.3) and the broad goals of socially just environmental policies (cf. Section 2.4). This makes it necessary to make broad use of the Better Regulation Toolboxes, particularly the tools 29 (employment), 30 (education & training), 31 (health impacts), 32 (consumers), 33 (territorial impacts), and, regarding international effects, 34 (developing countries).

- Apart from impact assessments and evaluations at the level of specific measures, regularly updated indicators (like the existing SDG and Social Scoreboard indicators) can help monitoring whether (and to what degree) the green transition evolves in a socially just way. However, with high-level indicators so far being separated along the three sustainability dimensions, it might be worth looking for and **defining (high-level) indicators at the environmental-social (or environmental-economic) nexus**.
- While social effects of climate and energy policy are a well-developed research field, **the entire spectrum of potential social impacts also in other domains of environmental policy (see Section 3) should be better reflected in research**. Additional research is also required on the **governance of just sustainability transitions** (e.g., enabling conditions, barriers, effective governance approaches, socioeconomic support measures etc.) – again, not on only with regard to climate and energy issues (e.g., coal regions, energy poverty) but also in fields like housing, mobility, agriculture / nutrition as well as the ongoing digital transformation.

5.2. Specific recommendations on industry transitions, regions and workers

- On the international level, the Commission and Member State governments should **engage in the international Working Group on Just Transition and Decent Work**, which forms part of the Marrakech Partnership Global Climate Action.
- In addition, the Commission should **support multi-level cooperation and learning between Member States and regions in platforms and workings groups**. **The "Platform for Coal and Carbon-Intensive Regions in Transition (CCIRIT)" is a good example and similar initiatives could be started with regard to other resource-intensive sectors**, as acknowledged by the Commission's SDG Reflection Paper (EC 2019a). The EU can support Member States, regional authorities and stakeholders in their efforts for a Just Transition by providing a platform, relevant data, analytical tools, funding and best practices (Popp & Fischer 2019).
- At least **for some sectors, (just) transition roadmaps must be discussed together** due to high intersectoral interdependencies. For example, a carbon-neutral chemical industry in the future, as well as other energy-intensive industries, will depend on and might compete for huge amounts of renewable energy, hydrogen and fossil-free carbon sources (Heyen et al. forthcoming).
- **Current EU funds for regional development and cohesion could and should better assist sustainability transitions**. Communities should receive financial support for developing and implementing long-term strategies integrating sustainable businesses, social well-being and environmental integrity. Improved synergies between different funding instruments could achieve a more systemic response to regional challenges. **For a proper use of the funds, political priorities and objectives must be set accordingly, be included in the funds' programming, and monitored by the Commission** (Popp & Fischer 2019). Care must be taken that funding is really used for a Just Transition towards a Green Economy and that it reaches the target group.
- **Grants and R&D subsidies (including in "Horizon Europe") as well as CAP payments to farmers should be more strictly focussed towards green technologies and practices**.
- The Commission should **work closely with national educational authorities and social partners on future changes in working skills**. The existing "EU Skills Panorama" is already a useful instrument that, in updated form, can help map changing skills needs in individual sectors. Regional data would help regions design their own educational strategies (Popp & Fischer 2019).
- The EU should support existing or initiate new **programmes that attract and support women in starting apprenticeships and careers in green technology sectors**, including through founding new businesses and becoming company successors.

- The EU could also **broaden companies' climate-related disclosure requirements to include disclosure of employment risks and just transition plans to address them** (JTC 2017).
- To protect, over the course of transitions, European industries (and workers) against unfair international competition and to avoid "carbon leakage", the EU should continue its work to **develop and implement a WTO-compatible carbon border tax**.

5.3. Specific recommendations on consumers and vulnerable households

- **Consumers and civil society representatives should be invited and empowered to participate in the development of (just) transition schemes and processes**, so that their perspectives – needs, concerns, ideas – can be included in the transitions' governance. This will support the inclusiveness, fairness and ultimately the social acceptance of such processes.
- The EU should **foster data collection, cooperation and learning among Member States on how to mitigate negative social impacts, especially on vulnerable consumers**. This could be based on or be connected to the existing **EU Energy Poverty Observatory which requires a permanent basis** and could be extended to further issues, such as mobility.
- Given the high relevance of building conditions for energy consumption and costs, the EU should not only set energy standards for these but **use funds for co-financing Member State support schemes for energy efficient renovations**, paying attention to a socially fair distribution of costs and benefits between landlords and tenants (Pye et al. 2015; Schumacher et al. 2015).
- The EU should continue **setting minimum standards for energy efficiency of appliances** and continue to **increasingly include resource efficiency aspects like repairability and durability in its Ecodesign Directive and specific regulations**. This can help to reduce both resource consumption and household expenditure for energy or new products.
- **Energy labelling, like for household appliances and cars, should mainly be based on absolute consumption levels** (i.e. energy costs) instead of size-dependent efficiency. Again, this can help to reduce both energy consumption and households' energy costs.
- **Member State policies to support energy-poor households should generally be coupled with information on energy saving options** through efficiency gains but also sufficiency, i.e. behavioural change (Cludius et al. 2018; Grießhammer & Fischer 2013).
- **Special attention should be given in Member States' policy-making to low-income households who do not receive welfare payments**, e.g. precarious employees (Cludius et al. 2018).
- The EU should **foster the transparent monitoring and evaluation of EU and Member State policies and programmes**, especially with regard to whether the target groups can be adequately reached and whether funding is used efficiently (Noka et al. 2019). With regard to indicators, they could be differentiated more often along socioeconomic and sociodemographic groups.
- To avoid new burdens and risks, and with respect to the "precautionary principle", the EU and Member States should **apply equally rigorous anti-hazard and anti-pollution policies to green technologies and products**. Continuous research is also needed to evaluate the environment and health risks of new technologies and substances as well as their recycling.

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