

# Towards a just and equitable low-carbon energy transition

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## Headlines

- The transition to a low-carbon economy is gathering pace. The Paris Agreement, the plunging cost of renewables, batteries and electric vehicles, and widespread policy action across the globe are all contributing to this acceleration.
- Whilst this is positive in many respects, it calls into question the degree to which a rapid low-carbon transition may adversely affect certain economic sectors, communities and regions.
- Such effects include: job losses in sectors such as fossil fuel extraction, with few other opportunities for workers to reskill or retrain; energy price rises for poorer households (for example as a result of fossil fuel subsidy removal); and the possible compromise to land and livelihoods caused by the rapid expansion of renewables and other low-carbon energy sources, without due consideration of the rights of those affected.
- Our understanding of the policies and measures that can help us achieve a more just and equitable transition to a low-carbon future is improving, demonstrating how to address the adverse impacts on specific vulnerable industry sectors, groups of people and communities.
- Long term-visions towards alternative industries and activities, with early implementation of policies to avoid abrupt changes, can support successful transitions. In addition, social dialogue between governments, businesses and labour unions is critical to ensuring all voices are heard.
- A range of measures such as near-term employment and wage protections, medium-term retraining and investment in alternative industries, and long-term education and innovation investment are central to ensuring protection and prosperity for people and communities.
- It is therefore imperative that governments work closely with businesses, local communities and labour representatives to produce long-term visions of successful, just and equitable transitions around which all stakeholders' voices are considered.

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## Summary

In many countries, regions and economic sectors, a transition to a low-carbon energy system is underway, and there are signs that its pace could accelerate. The momentum to reduce greenhouse gas emissions created by the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement, and recent spectacular cost reductions in solar photovoltaics, wind power and batteries, mean that governments, businesses and consumers are looking at alternatives to carbon-intensive energy sources, technologies and practices.

This momentum is positive from a climate change perspective, but calls into question how beneficial a low-carbon transition might be for all stakeholders. For example, a rapid decline in parts of the fossil fuel extraction sector (such as coal mining) may result in abrupt job losses, often with few other opportunities for which workers can reskill or retrain. The result of such changes in employment, and the potential spatial concentration of these changes, could be very damaging for individual livelihoods, states of mental and physical health and the quality of lives, as well as for specific communities and regions. Moreover, these negative impacts could weaken support for, and indeed create considerable resistance towards, the low-carbon transition, when – given the urgency of decarbonising – there is little time to waste and little room for any transition to stall or even reverse.

This paper presents a review of existing literature on the different aspects of minimising the adverse social and spatial impacts of transitions to low-carbon economies. Specifically, it focuses on understanding which regions, sectors and groups could be adversely affected, and what lessons can be learned from past and current transitions, so as to inform actions to minimise the adverse impacts of current and future transitions.

A central aspect of the transition to a low-carbon economy is that of “just transitions”, a term which arose in the late 1970s when labour unions in the United States sought support for workers in polluting industries whose jobs were threatened by environmental regulations, as well as financial support to invest in alternative industries. Just transition has now become a recognized international norm, as embodied in the United Nations (UN) International Labour Organization (ILO)’s 2015 *Guidelines for a just transition towards environmentally sustainable economies and societies for all* and referenced in the Paris Agreement. As well as discussing just transitions, this study considers other aspects relating to the distributional impacts of low-carbon transitions, such as the effects on poorer households of removing fossil fuel subsidies, the implications of lost fossil fuel related revenues for particular countries and regions, the potentially adverse consequences of the rapid deployment of low-carbon technologies for some communities, and issues concerning the potential decline of regions which are heavily dependent on carbon-intensive industries.

Recent estimates suggest that in a low-carbon transition consistent with a target of limiting climate change to less than 2°C above pre-industrial average temperatures, changes in energy production and use would lead to the loss of 6 million jobs globally by 2030, but to the creation of 24 million new jobs globally, compared to a ‘business as usual’ pathway in which no action is taken. However, not all regions would see net job creation, with the Middle East and Africa experiencing net losses of over 300,000 jobs each if their economic structure were to stay in line with historical trends. Furthermore, different regions could face very different economic costs of reducing emissions, with fossil fuel exporters (Middle East Organization of Petroleum Exporting Countries, Russia and Former Soviet States of Central Asia) and those countries holding large carbon reserves particularly affected. And impacts are likely to be unevenly distributed within countries – for example in India, royalties from coal make up almost 50% of revenues for some states.

Low-carbon technologies can themselves be the source of injustice. Examples include: the corporate takeover of community based renewables investment in one region in Germany, displacing investment and ownership by local community groups that initially supported such schemes; poor working conditions in the Brazilian biofuels industry; health problems caused by toxic wastes from the semiconductor manufacture central to the solar photovoltaics industry; and the dispossession of vulnerable communities from their land as part of a large Indian solar park scheme. Such examples highlight that replacing fossil fuels with low-carbon energy sources will not in and of itself address injustices.

There is an expanding literature on the measures and circumstances that have been successful in mitigating the adverse impacts on specific industry sectors, often of a fossil fuel intensive nature. Examples include the West German Ruhr region’s fundamental change from a coal and steel-based economy to a knowledge-based service economy during the 1990s and early 2000s, and the coal phase-out of Ontario, Canada, which was completed in 2014. Other examples of energy transitions which incorporate support for vulnerable groups include the removal of fossil fuel subsidies, such as in Ghana where petroleum subsidy removal was accompanied by compensating measures (eliminating school attendance fees, increased healthcare funding, infrastructure support and an increased minimum wage) aimed at the poorest members of society. Outside of the energy sector, the trade literature suggests that well-designed combinations of policies and measures, such as unemployment benefits and retraining policies, are the most effective at minimising the adjustment costs resulting from trade liberalisation. Common features of successful transitions include:

- Early implementation of policies and strategies to enable a managed decline of industries, supported by a long-term vision to support the growth of new industries;

- Close collaboration and social dialogue between central governments, local government authorities, businesses and labour unions, to ensure procedural justice and buy-in from the major transition stakeholders;
- Social protections such as wage guarantees, pension rights, healthcare benefits, cash transfers and early retirement packages to mitigate workers' economic losses in the short-term;
- Government and business investment in infrastructure, skills and retraining for affected workers and establishment of alternative industries to prevent industrial decline over the medium term;
- Government and business investment in education and innovation, to support new industries that contribute to long-term regional growth and prosperity.

The ILO's just transition guidelines reflect many of these features and provide a vital set of principles around which to design transition policies and measures so as to avoid adverse impacts for workers. But there remains a need for further analysis and consideration around many aspects of low-carbon transitions, including their wider distributional implications, their costs and benefits; and effective governance mechanisms which are appropriate to different social and political contexts.

## Introduction

A rapid low-carbon transition may not only result in new industrial and employment opportunities, but also in stranded workers and communities. Carbon intensive fuels, technologies and activities may become obsolete without sufficient time or warning to mitigate the adverse impacts on output and employment, and in the communities in which carbon intensive industries are concentrated. At the same time, a rush towards low-carbon energy sources could risk disenfranchising those whose land or livelihoods are compromised because of the arrival and expansion of such sources, without due consideration of the rights of those affected.

A number of adverse consequences could result: for example specific industrial sectors, regions and communities dependent on such carbon-intensive activities could see industrial decline and job losses; states dependent on revenues from fossil fuel extraction would see the loss of a valuable source of income; some communities could be adversely impacted by the arrival of new low-carbon technologies and activities if these encroach on their land and livelihoods; and households could see their energy costs rise, perhaps because of more expensive low-carbon energy, or because of the removal of fossil fuel subsidies. This in turn could lead to resistance to change, embodied by social and political backlash and a potential slowing or reversal of the transition. As such, it is important to establish which economy sectors, regions and socio-demographic groups are most at risk, and to explore ways in which these risks can be mitigated so as to achieve a manageable and just transition to a low-carbon future.

The Paris Climate Agreement calls on its Parties to take 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”*.

There have been important recent examples of long-term social and economic changes leading to such resistance. Most prominently, increased immigration into the United Kingdom (UK) is widely considered to be a major cause of the feeling of disenfranchisement experienced by many indigenous citizens, laying the conditions for the June 2016 ‘Brexit’ vote for the UK to leave the European Union (EU)<sup>2</sup>. This is likely to be a significant barrier to the continued trend towards an open market for labour (and possibly also goods, depending on the final trade arrangements that result) and free movement of people across an expanding EU. Later in 2016, in contrast to the predictions of the majority of opinion polls and political commentators, Donald Trump was elected as the 45th President of the US, on a campaign ticket to “Make America Great Again”<sup>3</sup>, including a resistance to and reversal of outsourcing of indigenous US jobs overseas, and a stemming of trade openness (as well as a commitment to exit the Paris Agreement).

The ‘Brexit-Trump’ phenomenon of 2016 has been cited by many as a backlash against more than two decades of increased globalisation<sup>4</sup>, and with it cosmopolitanism and openness to trade and the relatively unhindered movement of workers and their families. It is not inconceivable that a significant backlash of a similar nature could result from the disenfranchised workers and communities created by the downsizing or complete closure of fossil fuel intensive industries such as coal mining, oil and gas extraction and refining, and the downstream activities that further process and use these fossil fuels. As of early 2018, the US and world media was replete with headlines about the President’s planned use of emergency laws to halt the early closure of coal-fired power plants as a result of their increasingly unfavourable economics<sup>5</sup>.

Recent years have seen a change in sentiment about the prospects of a rapid low-carbon energy transition from fossil fuel intensive technologies (such as coal, oil and gas-fired power plants, and internal combustion engine vehicles) to low-carbon technologies (such as solar and wind power, and electric vehicles). Specifically the discourse related to the level of difficulty, on technology cost and performance grounds, and the associated expectation of a relatively gradual transition appear to be reducing with time. This change follows from faster-than-expected reductions in the costs of key low-carbon technologies (in particular wind, solar photovoltaics (PV), batteries and electric vehicles)<sup>6</sup> and an acceleration in the deployment of these technologies, leading one prominent commentator to remark that we are finally “winning the carbon war”<sup>7</sup>. This change in pace could lead to reductions in the demand for fossil fuels that are significantly faster than currently projected by the fossil fuel companies themselves<sup>6</sup>.

The possibility for disruptive changes, in which a potentially large number of private and state-owned fossil fuel enterprises suffer significant economic losses or fail altogether because of their inability to foresee the rapidity of such changes or adapt in light of them, is therefore increasing. In addition, and as discussed later, a rapid deployment of new low-carbon technologies, without time to fully consider their impact on countries, regions and communities, could also be disruptive.

The social aspects of energy transitions have been underexplored compared to analysis of the technologies and measures that would be needed to achieve energy goals such as decarbonisation and secure access to energy supplies<sup>8</sup>. In addition, it has been asserted that socio-technical transitions analysis has underemphasised the role of politics and power in such transitions, with future research needing to pay more attention to the decline of existing fossil fuel regimes and the resistance that such regimes could provide to the low-carbon transition<sup>9</sup>. There have been recent calls for a greater recognition of the socio-economic costs of decarbonisation policies which can hinder support for those policies<sup>10</sup>, in contrast to the overly technological and relatively narrow economic focus of current national energy policy and planning documents<sup>11</sup>.

In such circumstances, it is important to consider how national and local governments and international governance organisations might plan for such possibilities, in terms of the design of their low-carbon policies as well as any economic and social policies intended to address the adverse consequences of the low-carbon transition. This briefing paper is a review of the existing literature which covers numerous aspects of this question. The paper frames its focus by explaining how it relates to the just transitions agenda, as well as how it encompasses wider normative issues arising in energy transitions. It then presents evidence that there could be a rapid low-carbon transition which may catch businesses and policy makers unaware and which could have significant implications for the economic prospects of certain sectors and regions. An examination of which sectors and regions could be most negatively impacted by a low carbon transition is followed by an exploration of other significant industrial and policy transitions to draw lessons on how employees and regions associated with negatively impacted sectors could be supported. The following section summarises the proposed approaches to address declining carbon-intensive industries and regions in a low-carbon transition and the final section offers concluding remarks.

## The just transitions agenda and wider normative issues arising in energy transitions

A central aspect of the transition to a low-carbon economy is that of 'just transitions', a term which arose in the late 1970s when labour unions in the United States (US) sought support (including wages, retraining and relocation support) for

workers in polluting industries whose jobs were threatened by environmental regulations, as well as financial support to invest in alternative industries<sup>12</sup> (see Box 1). Just transition has now become a recognized international norm, as embodied in the UN International Labour Organization (ILO)'s 2015 *Guidelines for a just transition towards environmentally sustainable economies and societies for all*<sup>13</sup> and referenced in the Paris Agreement.

Whilst this paper discusses the concept of just transitions and its implications for the workforce, it also encompasses other aspects relating to the distributional impacts of low-carbon transitions, such as the effects on poorer households of removing fossil fuel subsidies, the implications of lost fossil fuel related revenues for particular countries and regions, the potentially adverse consequences of the rapid deployment of low-carbon technologies for some communities, and issues concerning the potential decline of regions which are heavily dependent on carbon-intensive industries.

### Box 1: Where did the term 'just transition' come from?

The Trades Union Congress (2012)<sup>12</sup> assigns the first use of the term 'just transition' to Tony Mazzocchi around the late 1970s. Mazzocchi was a senior official in the US Oil, Chemical and Atomic Workers (OCAW) union, which faced the prospect of closure of a number of industries due to environmental sustainability concerns. A Federal Superfund Law provided millions of dollars to clean up contaminated land but no compensation for displaced workers. Mazzocchi advocated for a just transition strategy which accepted the closures, but also proposed a government funded scheme to provide wages, retraining and relocation support for workers, as well as financial support and technical assistance for the development of alternative industries and jobs for displaced workers. The fund would be directed by government, industry, labour and environmental representatives. Mazzocchi's proposals were largely modelled on the massive US Servicemen's Readjustment Act of 1944, to help transition over 15 million WWII veterans back into civilian life, providing wages and tuition for up to four years. The Act eventually funded almost 6 million servicemen through education programmes and according to one estimate eventually reaped an estimated \$7 in economic growth and taxes for every \$1 spent<sup>14</sup>.

Issues of justice in energy transitions have in many cases been situated in the broader context of the socio-technical transitions literature<sup>15</sup>, which analyses the processes by which new technologies penetrate into existing markets and technological regimes<sup>16</sup>. Energy justice relates to many aspects beyond energy transitions and encompasses normative issues other than distributive justice. For example Sovacool et al.'s (2015) eight principles of energy justice are availability, affordability, due process, transparency, sustainability, inter-generational equity, intra-generational equity, and responsibility<sup>17</sup>. In addition, there

is a large literature on environmental and climate justice<sup>18</sup> and certain energy justice issues are closely related to some of these aspects, such as the intergenerational justice of acting on climate change to protect future generations<sup>15</sup>. There is also a large philosophical literature on ‘climate ethics’ and ‘climate justice’ (for a recent overview, see Green, 2017<sup>19</sup>).

This review is primarily focused on a consideration of the distributive consequences of energy transitions (hence distributive energy justice) but in drawing lessons for policy makers on how more equitable energy transitions can be realised, also concerns the processes by which these transitions are managed (hence procedural energy justice). An important point to note is that, whilst a key motivation of this paper, as the introduction stated, is to explore how we might avoid resistance and backlash against a low-carbon transition through failing to adequately support those who stand to lose out, the focus of drawing lessons from past transitions is on seeking to ensure that low-carbon transitions are equitable, rather than purely on making them politically acceptable, regardless of their overall distributive consequences.

## What are the drivers and possible consequences of a rapid low-carbon transition?

There are multiple drivers of the low-carbon transition that appears to be gathering pace. These include the surge of bottom-up initiatives towards the end of the 2000s by local community groups, some multinational corporations and institutional investors, as well as subnational (city and municipal group) authorities, often coming together into transnational initiatives<sup>20</sup>. In addition and critically, they include the growing realisation that the costs and other barriers to low-

carbon transitions are lower than previously thought<sup>20</sup>, with the falling costs of solar PV being the exemplar of how low-carbon technology deployment could be cost-effective.

These factors, among others, have been identified as central to the success of the 2015 Paris Agreement (or at least the relative success compared to the disappointment of the Copenhagen summit six years earlier)<sup>21</sup>. The other factors include the role of the scientific community in presenting the risks of climate change (as encompassed in the Intergovernmental Panel on Climate Change’s (IPCC) Fifth Assessment report of 2014<sup>22</sup>); the role of the economic community in highlighting the financial opportunities and risks, for example Carbon Tracker’s much popularised analysis on unburnable carbon reserves<sup>23</sup> and the New Climate Economy report on the economic opportunities and co-benefits of decarbonising<sup>24</sup>; the business community’s increasingly ambitious plans (such as those of Unilever); and activism from the Non-Governmental Organisation (NGO) community, for example on the issue of divestment from fossil fuels<sup>21</sup>. Whilst each of these communities is likely to continue to exert considerable pressure on governments to drive the low-carbon transition forward, it is arguably the falling cost of low-carbon technologies that will be the most important driver of a rapid displacement of fossil fuel technologies and the associated challenges that this would entail if not managed appropriately.

The scale of the consequences of low-carbon transitions on the fossil fuel industry can be understood by examining the impact of modelled mitigation scenarios to achieve different global temperature targets, as shown in Figure 1. In 2°C-consistent scenarios, the median of these scenarios entails a peak in global absolute fossil fuel demand by 2030 and an increasing rate of decline thereafter, whilst in 1.5°C-consistent scenarios the decline is already underway in the 2020s, with an approximate halving of the current fossil fuel industry size (in energy supply terms) by 2050.

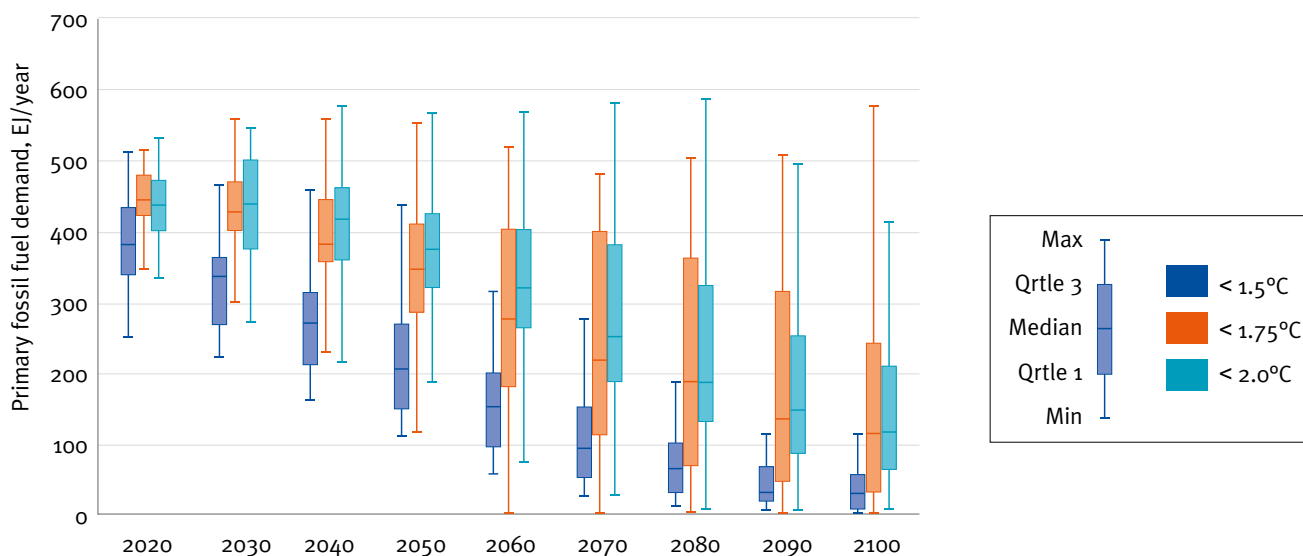


Figure 1: Global fossil fuel demand in a range of 1.5-2°C scenarios, 2020-2100 (based on data from IIASA<sup>25</sup> and Rogelj et al., 2015<sup>26</sup>)

Yet these scenarios could be conservative for some sectors, if the low-carbon transition takes hold based on the more favourable economics of low-carbon technologies compared to carbon-intensive incumbent technologies. For example recent analysis of the implications of falling solar PV costs finds that the models used to simulate the transformation of low-carbon energy systems have been conservative in their projections of the costs of solar PV and therefore the share of solar PV in the power sector<sup>27</sup>, whilst other analysis has suggested that electric vehicles could quickly come to dominate the road transport vehicles markets – again based on their increasingly favourable costs when compared with internal combustion engine vehicles<sup>6</sup>. These more aggressive scenarios do not even consider the co-benefits of these low-carbon technologies, such as increased energy security and reduced local air pollution, which could be additional drivers of the low-carbon technology substitutions analysed. It is for these reasons that even those analysts and commentators who have been traditionally more pessimistic<sup>28</sup> about the prospects of a low-carbon transition are now increasingly taking it as a given<sup>29</sup>.

## Who is likely to be adversely affected by a low-carbon transition?

Any analysis of potential vulnerability to a low-carbon transition must consider not just the decline in the fossil fuel industry, as highlighted above, but also the countries, regions and communities dependent on the continued operation of that industry. Specific socio-economic groups and sectors that could be adversely affected include poor and middle income households facing higher energy and food prices due to fossil fuel subsidy removal and carbon pricing, energy-intensive and trade-exposed economies losing competitiveness due to environmental regulations, and coal (as well as other fossil fuel) workers as these fossil fuel sources are phased out<sup>30</sup>.

Low-carbon pathways modelling suggests that different regions could face very different mitigation costs in a 2°C scenario, with fossil fuel exporters (Middle East Organization of Petroleum Exporting Countries, Russia and Former Soviet States of Central Asia) particularly affected<sup>31</sup>. In addition, several regions would hold ‘unburnable’ fossil fuel reserves (reserves that cannot be burned without compromising the climate goals, rather than that they literally cannot be burned), with the Middle East possessing over half of the unburnable oil and gas globally, and Russia a third of the globally unburnable gas, even when carbon capture technology is assumed to be available from 2025<sup>32</sup>. The potentially inflated value of such reserves which cannot be exploited in practice is commonly referred to as the ‘carbon bubble’.

In terms of employment, it has recently been estimated that in a low-carbon transition consistent with a 2°C climate target, changes in energy production and use would lead to the loss of 6 million jobs globally by 2030, while creating 24 million new

jobs, compared to a ‘business as usual’ pathway<sup>33</sup> in which no action is taken. However, not all regions would see net job creation, with the Middle East and Africa experiencing net job losses of over 300,000 jobs each if their economic structure were to stay in line with historical trends<sup>33</sup>.

Helm (2017)<sup>29</sup> contends that certain world regions will face particularly adverse impacts from a low-carbon transition, including the Middle East and Russia, owing to their economies’ oil and gas dependency, whilst China’s prospects of competing in a low-carbon global economy could be hampered by a lack of knowledge and skills. Europe and the US, on the other hand, are likely to fare much better according to Helm, with lower fossil fuel import prices, less overall fossil fuel import dependency (in the US in particular owing to its shale oil and gas boom) and the prospect of internationally competitive low-carbon and digital technologies driven by their high-tech research and development (R&D) institutions and highly skilled labour endowments. As for specific sectors, Helm argues that major oil companies and utilities could both suffer in a low-carbon transition, the former because it lacks particular skills to compete in the supply of new energy sources (though with some exceptions such as biofuels, which require similar refining and transport infrastructure to oil and gas), and the latter because vertically integrated businesses based on centralised, large, load-following fossil fuel plants have seen fast-declining revenues with the coming of zero marginal cost, often distributed, renewables<sup>29</sup>. Others disagree with Helm’s views. For example, Nahm and Steinfeld (2014) contend that China has developed unique capabilities in technology commercialisation and manufacturing-related innovation, as evidenced by its rapid dominance of the solar PV and wind sectors, indicating that it could be well placed to outcompete other nations in a range of other low-carbon technologies<sup>34</sup>. And utilities such as Germany’s RWE Group are changing their business models from traditional vertical integration to focus on power generation, capitalising on scale to try to gain dominance in renewable energy<sup>35</sup>. So the future of certain regions, sectors and companies remains open.

A growing literature notes with rather greater consensus the potential for stranded fossil fuel-intensive assets if decarbonisation efforts in line with a 2°C climate target begin by 2020. Estimates range from hundreds of gigawatts (GW) to potentially more than 1,000 GW of coal fired power stations being scrapped by 2030, in some cases several years before the end of their economic lives<sup>36, 37, 38</sup>. Recent analysis of the implications of a 1.5°C target finds that current committed emissions from existing coal plants, at 245 gigatonnes of carbon dioxide (GtCO<sub>2</sub>) by 2016, would eat up most of the carbon budget associated with the temperature target and imply stranding of a significant share of these plants unless retrofitted with carbon capture and storage<sup>39</sup>.

Further upstream, combustion emissions from burning the coal in existing mines would be 425 GtCO<sub>2</sub>, indicating that these resources could not be exploited in a 1.5°C scenario<sup>39</sup>.

This adds further evidence to the financial risk analysis based on the ‘carbon bubble’ concept which highlights the degree to which fossil fuel reserves must remain in the ground if we are to meet international climate targets<sup>23, 32</sup>. However, the low share of capital expenditure in the production cost of coal means that the main asset stranding would not be a result of the physical assets, but of lost market capitalisation of coal mining companies<sup>39</sup>.

The International Energy Agency (2017) estimates that, in its ‘66% 2°C’ scenario (which means that there is a 66% chance of staying below 2°C if the mitigation pathway is followed) around 1 million direct jobs would be lost from the premature closure of coal mining assets, representing about 20% of current coal mining employment. This compares to the current 30 million jobs in the energy sector<sup>40</sup>. Whilst in many regions coal mining is a relatively insignificant employer (e.g. 66,000 jobs in the US compared to 153 million total jobs, and 359,000 direct jobs in India compared to 490 million total jobs, i.e. less than 0.1% of each total) these jobs are concentrated in certain regions and coal can be a significant source of export revenues. For example in India, royalties from coal make up almost 50% of revenues for some states, for example Jharkhand and Odisha in the East. Coal also makes up a large share of total merchandise exports in certain countries (for example 6% in South Africa, 15% in Australia)<sup>39</sup>.

In addition to the possible consequences for fossil fuel intensive sectors and those dependent on fossil fuel extraction and use, it has been recognised that low-carbon technologies can themselves be the source of injustice. One example is the impact of rapid investment in renewables on a region (Lower Franconia) in the Federal State of Bavaria in Germany, where initially renewables schemes were community-driven through local cooperatives. However, they quickly became dominated by big corporate investors from outside the region, thereby disenfranchising the local community and separating it from both significant parts of its land as well as its ownership of low-carbon assets. In large part this dominance followed from the institutional rules around funding and siting of renewables, which favoured larger investors with higher risk tolerances<sup>41</sup>. Other examples of unjust low-carbon transitions include the alleged poor working conditions, including child and slave labour, in the Brazilian biofuels industry, as well as the health problems caused by toxic wastes from the semiconductor manufacture that is central to the solar PV industry<sup>45</sup>. A further recent analysis of a large solar park development in Gujarat in India points towards the dispossession of vulnerable communities from their land in developing this park<sup>42</sup> – is a clear case of enclosing, commodifying and privatising land<sup>43</sup>. Such examples have led to the assertion that replacing fossil fuels with low-carbon energy sources will not in and of itself rule out or address injustices including the inequitable distribution of environmental hazards and the lack of influence of communities affected by these new sources<sup>44</sup>.

## What do other rapid policy and industrial transitions indicate about measures to support vulnerable groups?

In the energy sector, increasing attention has recently been drawn to the different ways in which incumbent industries’ resistance to change could be ‘overcome’ through a variety of strategies, including nurturing and entrenching low-carbon political constituencies and sectors and implementing policies to change the incentive structures of incumbent industries<sup>45</sup>. Indeed a specific term, ‘exnovation’, has been used to describe the process of deliberately ending fossil fuel based technological trajectories, with a focus on policy instruments to accelerate the closure of fossil-intensive technologies<sup>46</sup>. In addition, there have been numerous attempts to understand and organise within specified conceptual frameworks the different pressures that led to the failure of certain energy technology innovations (for example the failed attempt to introduce liquid fuel alternatives to oil in the UK during the inter-War years<sup>47</sup>), as well as to the destabilisation and decline of once-dominant industries (for example the demise of the UK coal industry<sup>48</sup>). However, these examples do not focus on justice, but rather on accelerating the transition away from fossil fuels, in some cases regardless of considerations of justice. Fortunately there is an expanding literature on the specific policy mechanisms and other actions that have been successful in mitigating the negative impacts associated with different industry sectors, often of a fossil fuel intensive nature. This section first examines the case of transitions away from coal mining, before then discussing other transitions examples, both inside and outside the energy sector.

### Coal transitions

One commentary<sup>39</sup> on historical policy measures to support coal transitions notes that in liberal economies (e.g. UK and US) there has been limited assistance of an ad hoc nature, whereas in other economies with greater state-industry-union coordination (e.g. Spain, Poland, Czech Republic) there have been high levels of compensation for workers and businesses. Overall there has been a less-than-reassuring set of historical precedents for coal sector transitions, with poor anticipation of the scale of the problem and poor management of (not always welcome) long-term relocation opportunities, reskilling and development of alternative economic activities. One exception is in Germany, where, faced with a decline in coal in the 1990s, the government used widespread retraining programmes to help coal workers find new jobs, often in renewables<sup>8</sup>.

Galgóczy's (2014)<sup>49</sup> deep dive into the West German Ruhr region's fundamental change from a coal and steel-based economy to a knowledge-based service economy seeks to draw explicit lessons from this 'exemplary case' of economic transformation. Key to success were the active management of economic diversification by the federal and regional governments, as well as workers' participation in the restructuring process. Over the period 1960-2001, the number of mining industry workers declined by 90%, to just 2.5% of the region's workforce, whilst iron and steel employment fell 80%. The initial response to this market-driven industrial decline – to attract extra-regional capital to shore up the industries – gave way to a more active diversification of the region's industries through industrial and technology policy. This bore fruit in the early 1990s when existing firms began to diversify into new activities, whilst the local government began to focus on innovation (particularly environmental technology, including R&D in renewables energy, recycling and waste combustion). Many former coal miners have found new employment in building restoration (including rooftop solar installations) and there are plans to convert a former mine site into a forest plantation. European funds have been targeted towards wage subsidies, labour market support and the development of new infrastructure, bringing with it new employment opportunities. A series of "socially responsible downsizing practices"<sup>49</sup> including worker redistribution between jobs, shifts and sites, early retirement support and worker retraining and development programmes have been central to the successful response to declining coal and steel demand since the early 1990s. Galgóczy concludes that co-operation between government, municipalities, employers and trade unions is a prerequisite for a successful transition, as is a clear vision of the future, supported by a comprehensive policy framework<sup>49</sup>.

Other examples of successful transitions from coal include the coal phase-out in Ontario, Canada, completed in 2014. Contributory factors included: cross-party political support for the phase out, largely on the basis of local air quality concerns; the fact that the Ontario government could absorb the cost of the phaseout as the plants were publicly owned; and a long-term vision and gradual implementation, including broad-based consultations with multiple stakeholders from civil society, municipalities and industry<sup>50</sup>. Numerous other just transitions initiatives and taskforces have now been established, including in New York<sup>51</sup>, Scotland<sup>52</sup> and New Zealand<sup>53</sup>.

Evans and Phelan (2016), focusing on the coal mining Hunter region of Australia, note the perceived importance of the mining sector by Australians, with the Australia Institute finding that on average people thought 16% of the population was employed in mining (of all varieties) and that it accounted for a third of national economic activity, compared to the actual figures of 1.9% and less than 10% respectively<sup>54</sup>. They assert the need for social movements that integrate environmental justice and just transitions so as to make communities more resilient and focused on equitable outcomes in the face of these transitions.

They use the example of the BHP steelworks closure in the late 1990s, which saw many elements of a just transition – two and a half years' notice for the final cohort of workers and packages of benefits, as well as a major programme ('Pathways') involving employees, unions and management to assist displaced workers. There was a 'Workforce Transition Committee' to ensure an orderly closure, whilst a company ('Pathways Employment Services') was set up to retrain the workforce. The New South Wales Government and BHP contributed to a \$30million fund to establish new jobs and industries in the region. In Geelong, the Trades and Labour Council has been involved in transition campaigns with other community organisations and local government, to oversee the transition from car manufacturing, aluminium smelting and oil refining, to a range of new industries. Local campaign groups and local governments have become actively involved in working towards broadening the economic base of regions through developing new skills and technologies and supporting new industries<sup>54</sup>.

However, other analysis contends that certain political-economic institutions and conditions would make relatively orderly and just transitions such as the German Ruhr and Australian Hunter cases challenging. For example, Wiseman et al. (2017) suggest that the relatively sudden closure of the Hazelwood coal mine and coal-fired power station in Australia in 2016 was a symptom of the liberalised electricity generation sector with power generators predominantly owned by multinational corporations responsible to foreign shareholders. This liberalised economic context, along with Australia's competitive and short-term electoral dynamics, and a legacy of divisive politics concerning climate policy and coal regions, was not conducive to longer-term transition planning and cooperation between the corporations, employees and government<sup>55</sup>. After the closure was announced, however, various measures to support workforce transition were able to be negotiated among the relevant union (which explicitly adopted a 'just transition' agenda), corporation and state government, including a worker transfer scheme and a large regional redevelopment package with worker-specific policies and more general regional investment.

## Other energy transitions

The removal of fossil fuel subsidies is one of the key issues facing governments in the transition to a low-carbon future. The savings from removing such subsidies can provide governments with valuable additional funds for social protection programmes to mitigate the impacts of the resulting increase in energy prices. For example, as part of its Structural Adjustment Programme, Ghana's government began removing petroleum subsidies from 2005, with compensating measures aimed at the poorest members of society including eliminating fees for attendance at primary and junior schools, increased funding for health care, urban public transport and rural electrification, as well as a 20% increase in the minimum wage. Whilst effective, the government has faced continuing pressure to reintroduce subsidies at times of rising oil prices<sup>56</sup>.



**Table 1: Just transition examples from OECD’s ‘Investing in Climate, Investing in Growth’ report<sup>57</sup>**

Level of organisation	Example	Just transition measures
Enterprise	Enel (Italian electricity multinational) currently closing 13GW of thermal power in Italy	Enel has entered into social dialogue and a framework agreement with union partners, covering: <ul style="list-style-type: none"> <li>• Retention</li> <li>• Reskilling</li> <li>• Early retirement</li> </ul>
Community	Automotive industry in Schweinfurt, Germany facing challenges of decarbonisation	Friends of the Earth Bavaria and Bavarian Metalworkers’ Union collaborating to identify how to improve energy efficiency of plants and processes, plan for demographic trends and develop skills, mobility and job creation.
	Port Augusta, Australia, which saw the closure of its last coal plant in 2016, developing renewable power	A citizen, worker and union plan (Repower Port Augusta, 2017) to support wind and solar power generation through attracting: <ul style="list-style-type: none"> <li>• Potential employers</li> <li>• Local government and international funding</li> </ul>
	Closure of Diablo Canyon nuclear power plant in California, US	Pacific Gas and Electric worked with the local trade union to prevent an abrupt shutdown (phasing out the plant over the next nine years) and during this time to develop a plan for: <ul style="list-style-type: none"> <li>• Annual bonuses</li> <li>• Severance packages</li> <li>• Retraining and redeployment</li> </ul>
Government	Canadian government announcement to phase out coal power (announced 2016)	Government commitment to work with provincial governments and organised labour to guide and support workers in the shift from coal, including a national just transition task force.
	Saudi Arabia government policy to improve energy efficiency	Establishment of training to support this through: <ul style="list-style-type: none"> <li>• Energy efficiency technical degree</li> <li>• Energy efficiency on curricula of engineering schools</li> <li>• Professional training for energy managers</li> </ul>

Table 1 summarises further examples of energy-related transition initiatives, as outlined in the OECD’s (2017) ‘Investing in Climate, Investing in Growth’ report<sup>57</sup>.

### Non-energy sector transitions

Outside the energy sector, there are numerous examples of policy design to achieve transitions in which there is some degree of preventing or reducing the negative consequences for adversely affected groups. Trebilcock’s (2014) *Dealing with Losers*<sup>58</sup> examines a number of such cases. For example, his analysis of the history of free trade agreements notes that ‘gradualism’ in the introduction of trade liberalisation (for example in Spain’s banking sector, which was allowed sufficient time to become competitive before being exposed to international competition) has been important in minimising adjustment costs and welfare losses. Other principles in free trade agreements include ‘reciprocity’ (i.e. that if one country opens up to trade from another, then it will benefit from that

country also opening its borders to trade), ‘reversibility’ (which in the General Agreement on Tariffs and Trade (GATT)/World Trade Organisation (WTO) framework allows the reversal of agreements in light of unexpected economic disruption from, for example, surges of imports), and labour market adjustment policies, with the literature suggesting that well-designed combinations of passive (i.e. unemployment safety net) and active (i.e. retraining) policies are the most effective at minimising the adjustment costs resulting from trade liberalisation.

It has been asserted that WTO negotiations are often conducted in secrecy, with insufficient impact assessments on labour, adjustment costs and processes<sup>59</sup>. A range of solutions include labour standards in trade agreements, as well as social protections, industrial policies, skills policies and employment services to guard against lock-in to low value-added specialisations. Such measures were enforced in South Africa’s clothing and textile sector, driven by the Workers Union in close

collaboration with the Ministry for Trade and Industry, which helped stem the loss of jobs in the sector as a result of trade liberalisation<sup>59</sup>. A further example comes from the Scottish jute (a natural fibre for ropes, nets and sacking) industry centred on Dundee which, in the face of increasingly cheap imports, was effectively protected by the UK government through linking all sale prices (of both domestically produced and imported jute) to the Scottish production cost, thereby circumventing international trade rules<sup>60</sup>.

The issue of trade liberalisation is linked to recent commentaries on the populist reaction to globalisation, as discussed in this paper's introduction. For example Rodríguez-Pose (2018) argues that inequalities resulting from 'agglomeration economies' (i.e. the benefits that derive from the clustering of industries and people in particular regions) have given rise to regions which have been left behind, with consequent populist reactions<sup>61</sup>. This "revenge of the places that don't matter" (as Rodríguez-Pose calls it), is in large part responsible for the Brexit, Trump and other recent nationalist uprisings, which have been exacerbated by a lack of focus on the economic distress caused in the left-behind regions and an overlooking of their economic potential, as well as an overestimation of the willingness and capacity of people to move away from these areas. Rodríguez-Pose (2018) asserts that maximising the development potential of these lagging areas is suggested as the best bet for addressing this issue – a clear call for regional and targeted industrial policy. This is asserted to be a more viable strategy than relying solely on existing social welfare policies, which can create permanently dependent regions and give rise to further social and political tensions<sup>61</sup>.

The issue of how to deal with globalisation's losers – whether through direct compensation and/or greater provision of public goods (as advocated by Roubini (2016)<sup>62</sup>), or whether through a more fundamental change to the rules of globalisation itself (as advocated by Rodrik (2017)<sup>4</sup>) – continues to be debated. But there is evidence that welfare policies such as labour market programmes have mitigated some of the adverse impacts of unemployment. For example, one recent empirical analysis of changes in employment and mortality across EU member states during the period 1970-2007 supports the notion that active labour market programmes that keep and reintegrate workers in jobs could mitigate some adverse health effects of economic downturns<sup>63</sup>.

Aside from trade liberalisation, industrial policies that have been deemed critical to the rapid development of Japan and the East Asian tiger economies in the post-WWII period have provided some lessons for dealing with sectors in decline. For example, Japan's policy mix included supporting traditional industries (through subsidies and relatively lower tax rates) and there was a specific programme (the 1978 law concerning 'Temporary Measures for Stabilization of Specific Depressed

Industries') to plan and support capacity reduction, reallocate resources and provide financial assistance to fourteen structurally depressed industries<sup>64</sup>. The OECD's (2017) '*Investing in climate, investing in growth*' report sets out specific examples of how, in the Japanese steel industry in the 1970s, financing instruments and other measures to promote energy efficiency, process improvements, and environmental protection were introduced<sup>65</sup>. More recently, policies to create jobs in depressed areas have been used in European steel<sup>66</sup>, and shipbuilding sites have been transformed in Denmark, in some cases to offshore wind building sites<sup>67</sup>.

A further relevant example of transitions (this time referring to one gathering pace) is the current move towards increased automation and use of artificial intelligence across many economic activities, with some analyses estimating a significant number of job losses over the coming years<sup>68</sup>, although others have asserted that there will also be significant economic benefits and job creation opportunities from this transition. Proposed measures to mitigate adverse impacts include models to spread the ownership of capital more widely<sup>69</sup>, development of targeted strategies (such as financial and psychological support) for those likely to be affected, adjustments to the education system to achieve adaptability in training in the context of the coming developments, and exploration of alternative income and taxation models and welfare policies<sup>70</sup>.

## Actions to mitigate the adverse impacts of the low-carbon transition

Across a range of case studies, a set of common features has been identified for successful transitions away from declining industries. The following sub-sections summarise these features.

### Foresight and timing to allow gradualism

Arguably above all, there needs to be sufficient time to allow transition measures to be agreed amongst stakeholders and put in place, with one analysis of past coal transitions suggesting that the whole transition process can take up to two decades<sup>71</sup>. As Muttitt (2016) notes: "leaving things until carbon budgets are mostly exhausted would result in disruptive change that would be sudden, costly, and painful. By starting now, the transition can be managed efficiently and fairly, to the maximum benefit of everyone involved."<sup>72</sup> Related to this concept is that of Trebilcock's (2014)<sup>58</sup> focus on gradualism, which could for example include border tax adjustments to protect carbon-intensive industries from losing out to less regulated overseas competitors in the short term, before climate policies such as carbon pricing are imposed more universally.

However, there is a risk that such policy prescriptions may be too late for a transition that is now gathering pace on the basis of bottom-up economic fundamentals as much as top-

down policy action, which may leave policy makers with limited scope to control the pace of the transition. In any case, given the imperative of rapid mitigation action to meet stringent international climate change goals, the window of opportunity for gradualism in this area of public policy is likely to be shrinking.

### The role of multiple, coordinated stakeholders

Several commentaries on successful transitions have pointed to the need for involvement of, dialogue between and coordination amongst government (both at central and regional levels), businesses and labour unions representing workers that stand to be affected by the transitions. Such social dialogue, or tripartism, is part of social legislation in European and some other countries, as well as the basis for ILO guidelines<sup>73</sup>. For example, analysing transitions in three coal and industrial regions in Europe (in the UK, Germany and Spain), Kumar et al. (2016) point to a number of common traits, including a cross-party political consensus for the transition, and ownership for the transitions amongst local leaders, supported by national governments and the EU<sup>71</sup>. Stevis and Felli (2015) highlight the importance of labour unions – which have been historically associated with social rather than environmental justice – in promoting just transitions that achieve both social and environmental justice<sup>74</sup>. Caldecott et al. (2017), analysing six case studies of coal mining closures across the US and EU, highlight the importance of a consensus between companies, workers and governments, with long-term policy commitments and a proactive approach to managing uncertainties in the face of unforeseen circumstances<sup>75</sup>. Sucháček (2005) contrasts the relatively successful restructuring (since the early 1990s) of the industrial Katowice conurbation in Poland with the relatively unsuccessful restructuring of the neighbouring Ostrava region in the Czech Republic, finding that the former benefited from a much closer and more constructive relationship between the central government and regional institutions<sup>76</sup>. Abraham (2017) argues that active union involvement in the transition of the Ruhr coal-mining region of Germany was central to its success, whereas a weaker union in the Appalachian coal mining region of the US has failed to secure a just transition including assurances of job security for displaced miners<sup>77</sup>. Of course, it is important to keep in mind the different ‘varieties of capitalism’<sup>78</sup> in which these diverse cases unfolded, since different political-economic institutions (dis)empower different actors and shape transition processes<sup>55</sup>.

Moreover, Heffron and McCauley (2017) argue that public acceptance and understanding are critical in moving society towards a just transition<sup>79</sup>, whilst Agyeman et al. (2016) point to the importance of recognising different places and the attachment of people and communities to those places, including the knowledge and solutions they can bring to problems of environmental justice<sup>80</sup>. Perhaps unsurprisingly, Miller et al. (2015) argue that energy transition plans must be widely publicised, discussed amongst stakeholders and

those impacted, with governance arrangements to manage organisational change, instil public confidence and trust and manage social and economic dislocation<sup>81</sup>.

### Active industrial policy

All case studies of successful transitions from carbon-intensive activities such as coal-mining, or other industries in decline, demonstrate a considerable role for active government involvement in steering regions towards new and alternative industries, including ‘green’ sectors<sup>10</sup>. Just transition policies have been divided into those which are ‘reactive’ and ‘proactive’ policies<sup>82</sup>. Reactive policies are aimed at helping workers in sectors negatively impacted by a low-carbon transition and include income support, retraining and career support, job transfers which help displaced workers into new jobs, pension bridging and workforce transition plans. Proactive policies are aimed at maximising the long-term benefits of the transition and include labour market modelling to identify sectors where skills are needed, targeted skills training, industrial transition support to help firms shift from high to low carbon activities, and geographically targeted public spending to help vulnerable regions<sup>82</sup>. Related to this short-term/long-term focus, Bridle et al. (2017) recommend policy prescriptions of short-term welfare payments or early retirement to alleviate poverty, medium term infrastructure spending and inward investment attraction to replace lost jobs, and long-term innovation and education to develop tomorrow’s industries<sup>83</sup>.

The UNFCCC’s (2016) Just Transition report<sup>84</sup> highlights that skills development is central to a successful transition to a green economy, with higher education and technology centres being key features of supporting a workforce equipped for a knowledge-based rather than coal and steel-based economy. In addition, the report outlines a number of important examples of how an existing workforce can in theory put its skills to use in low-carbon sectors. These include the transferability of skills from offshore oil and gas to the development of wind turbines and geothermal technology, the transfer of thermal plant operation skills to renewable plant operation, as well as an example from one study which highlights the potential (with appropriate retraining) for the entire US coal workforce to be re-employed in the US solar PV industry<sup>85</sup>.

When focusing on policies that offer transitional assistance, it is important to consider who should be given assistance (for example coal workers, those that depend on the activities of coal mining regions, and coal sector-specific asset owners) as well as what form of assistance should be given (some form of compensation for income or asset losses; assistance for retraining, relocation or economic development as well as for technology upgrading; and assistance to maintain community cultural and societal institutions and facilities)<sup>39, 86</sup>.

Caldecott et al. (2016) note that governments have borne large costs in supporting declining company profits, support for workers and for the reindustrialisation of regions<sup>75</sup>. Whilst they cannot give detailed estimates of the cost of job support in these regions, they point to two sources (one a Dutch case in which regional investment in new economic activities cost 300-400 thousand Euros per long-term job created, and one a Spanish case where subsidy support for mining jobs cost in the order of 250 thousand Euros per job over the period 1998-2014). They note that the social, economic and political costs of not making such investments could be very significant<sup>75</sup>.

### Policies to address distributional consequences of increasing the price of high-carbon fuels

Vogt-Schilb and Hallegatte (2017) argue that carbon pricing and fossil fuel subsidy removal policies can be designed with growth, development and distributional objectives at the forefront, leaving emissions reductions as additional benefits<sup>30</sup>. Whilst recent evidence suggests that reducing fossil fuel subsidies alone would have a relatively limited impact on emissions reductions<sup>87</sup>, there is evidence that reduced fossil fuel use through specific taxes on local pollutants could dramatically lower the use of coal, whilst improving local air quality<sup>30</sup>. Fossil fuel subsidy reform faces barriers because the initial justifications for these subsidies include improving energy access for poorer segments of society, but these can be addressed through instead using cash (or in some cases in-kind) transfers to help poorer households, rather than wholesale energy subsidies which are relatively regressive<sup>30</sup>.

Such transfers have been demonstrated to have multiple benefits including improvements in education, health, business creation and labour force participation<sup>30</sup>. Carbon pricing faces similar distributional issues, but governments can ameliorate these through a variety of measures. These include using carbon tax revenues to fund social assistance and inequality reduction programmes (again with the potential to use cash transfers), whilst reducing more distortionary taxes (such as labour taxes). In the latter case this is known as the 'double dividend' of carbon pricing, since it can both lower environmental pollution and increase economic efficiency through lowering more distortionary taxes<sup>30</sup>. However, even where carbon tax revenues are redistributed, further measures such as energy efficiency retrofits are likely to be necessary to assist low-income groups in houses with poor insulation and inefficient appliances<sup>88</sup>.

Gass and Echeverria (2017) note the potential of fossil fuel subsidy reform for financing just transition policies, given the huge sums spent on subsidies (\$425 billion globally in 2015), whilst noting that the lowest income quintile receives only 7% of these subsidies, implying that there need not be a complete removal of support to these groups even if just transition policies were to be funded through subsidy savings<sup>89</sup>.

### Further considerations and cautions

Many of the basic principles for successful transitions, as highlighted above, have been incorporated into the ILO's just transition guidelines<sup>13</sup>, which state the following:

- Local communities and unions have a key role to play in the shift to a low-emission climate-resilient economy, including identifying activities that can substitute the declining high-carbon ones.
- An active social dialogue is necessary between unions, employers, and local or central government.
- The transition needs to be anticipated years in advance in order to facilitate retraining and mobility plans.
- High-level policy and corporate commitments are vital, including funding commitments.
- Overall coordination, co-operation and trust among stakeholders is crucial.

Though useful in creating an international norm for just transitions, there is a need for more concrete applications of the ILO guidelines, yielding more examples of how just transitions can work in different political, social and economic contexts. It is also important to note that even just, well-managed transitions are not pain-free, since they are likely to include job losses and the uncertainty that comes with industrial closures.

In addition, Newell and Mulvaney (2013) suggest that we should be cautious about the ability of different institutions to manage the complex processes of the low-carbon transition, given the private sector's significant role in determining energy production and consumption in many regions, as well as the relative lack of powers held by global energy governance bodies<sup>15</sup>. Accordingly, as Green (2018) notes, state institutional capacities to steer complex, multi-stakeholder transitions over long time periods are likely to be a key variable affecting the success of transition policies<sup>86</sup>. Similarly, Hallegatte, Fay and Vogt-Schilb (2013) warn that industrial policies (green or not) seem particularly risky for countries with weak institutional capacity, weak civil society, and low transparency or accountability of governmental organizations. They appear more likely to succeed in high-capacity countries, with an educated population, high accountability, and where the main obstacle to economic growth is the low amount of physical capital, as in East Asia in the 1950s and 1960s<sup>64</sup>. They also note that it may be more efficient to hire workers in growing sectors than to support workers in declining industries, citing lessons from the trade adjustment cost literature<sup>90</sup>.

Some analysts have also noted that low-carbon technologies may themselves be promoted and deployed in ways which disenfranchise or sideline communities. For example, Galvin (2018) suggests that policy makers should be cautious about labelling local people and communities as problems to be overcome to get low-carbon projects implemented<sup>41</sup>. Rather, they

should recognise their particular enthusiasm and aspirations for how local projects should be implemented, as well as the stake that they want in these projects<sup>41</sup>.

Bridle et al. (2017)<sup>83</sup> draw attention to a number of limitations of attempted transitions, based on their review a number of case studies on the decline of the mining industry in Wales, Spain, and the US. They find that in the Welsh case, the then Welsh Development Agency attracted inward investment to replace mining and create alternative jobs. However, in many cases these were not of the same pay, status or skill level as the lost mining jobs, whilst long-term the restructuring of the economy suffered due to a loss in international competitiveness in newly attracted manufacturing industries. The Spanish case saw generous early retirement benefits which on the one hand kept people out of poverty and maintained demand for goods and services in the local economy, but on the other has been blamed for negative health effects (stemming from a lack of employment), a failure to stem outward migration, and reduced incentives for finding new employment. The US case (focusing on the Appalachian Kentucky region) saw the collection of a coal severance tax from coal sales, to fund a variety of economic development projects including industrial parks. However, there has been criticism that too much of this tax was absorbed into general state government funds and that it wasn't used in a sufficiently targeted way to revive the economic prospects of coal communities. Thus Bridle et al.'s policy prescriptions (short-term welfare payments or early retirement to alleviate poverty, medium term infrastructure spending and inward investment attraction to replace lost jobs, and long-term innovation and education to develop tomorrow's industries) are not guarantees of a pain-free transition.

Green (2017) highlights a number of normative issues for governments to consider in implementing just transition policies, including clearly specifying the justification for transitional assistance, which has implications for other transitions and social assistance programmes, as well as defining the scope of eligible claimants for assistance (such as asset owners, workers and those indirectly affected)<sup>39</sup>.

## Conclusions

There has been an increasing body of analysis and argument in support of a possibly rapid decline in the demand for the products of certain fossil fuel intensive sectors in the coming decades. This follows from the large number of low-carbon pathways scenarios consistent with achieving the Paris Agreement's long-term temperature goal to limit global warming to well below 2°C above pre-industrial levels. Many of these scenarios show an overall global stagnation and decline in fossil fuel demand which begins as soon as 2020. It also follows from the fact that recent cost reductions in some key low-carbon technologies including solar PV, wind and electric vehicles mean that these technologies will in many regions soon be able to

outcompete their fossil fuel counterparts on cost terms, even when not accounting for climate policies such as carbon pricing.

Analysis suggests the consequences of such carbon-intensive industrial decline may be relatively modest, with the emergence of new low-carbon sectors creating greater numbers of jobs. However, the concentration of job losses in certain countries, regions and localities means that the damages that could be felt from such unemployment, with the knock-on effects it has for social and economic decline, could be significant.

In addition, a rapid low-carbon transition could lead to adverse impacts on households and communities, including increased fuel prices and the arrival of new low-carbon energy sources and technologies on their land, without due consideration of their rights.

Given this analysis, in this final section this paper returns to the original question posed in the introduction: how might national and local governments and international governance organisations plan for such possibilities, in terms of the design of their low-carbon policies as well as any economic and social policies intended to address the adverse consequences of the low-carbon transition?

There is now a rich and expanding literature on previous industrial transitions, as well as numerous current examples of just transition plans, which helps to address this question. Through a number of case studies this literature highlights some common features of relatively successful transitions. These features include:

- Early implementation of policies and strategies to enable a managed decline of industries, supported by a long-term vision to promote the growth of new industries;
- Close collaboration and social dialogue between central governments, local government authorities, businesses and labour unions, as well as local communities, to ensure procedural justice and buy-in from the major transition stakeholders. Several countries already require such agreements by law or via collective bargaining agreements;
- Targeted social protections such as wage guarantees, pension rights, healthcare benefits and in some cases cash transfers and early retirement packages to mitigate workers' economic losses in the short-term;
- Government and business investment in infrastructure, skills and retraining for affected workers as well as establishment of alternative industries to prevent industrial decline over the medium term;
- Government and business investment in education and innovation, including in universities and technical schools, to support new industries that contribute to long-term regional growth and prosperity.

The ILO's guidelines, negotiated by over 160 governments, employer organisations and unions, are intended to be the precursor to a global labour standard to be negotiated in 2022. They contain principles that constitute one widely-agreed aspect of justice for workers in the low-carbon transition. Thus governments could employ a range of near-term responses (such as welfare support) as well as more proactive measures (planning, long-term education and investment) to address the adverse implications of industrial decline resulting from the low-carbon transition. Such principles around planning and social dialogue are clearly vital to other aspects of low-carbon transitions, including the upholding of rights and respect for livelihoods of those that are likely to be adversely affected.

However, there remain several significant questions. Specifically, there is a need for more examples, as well as comparative analysis, of how just transition principles are being or have been put to work in different political, social and economic contexts, since each context will afford different opportunities for social dialogue, bargaining power of unions, new job opportunities and economic development plans. In addition, further work is required to understand the wider distributional implications of low-carbon transitions, beyond the just transitions agenda, encompassing all of the possible adverse risks of rapid low-carbon transitions. This includes: a more thorough understanding and evaluation of the costs and benefits of these transitions and their distribution (across people, groups, sectors, and regions); case studies and comparative analysis of transition governance (strategies, mechanisms, organisations, and processes) in different countries and contexts; analysis of the social and political dimensions of transitions; and evaluation of transition policies in light of how effectively they meet their desired goals.

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