

Agulhas

Applied Knowledge

Lessons for a successful transition to a low carbon economy:

A report by Agulhas under a grant from the
Children's Investment Fund Foundation

Lucy Stone & Catherine Cameron

Case studies by Katerina Cerna, Dr Stephanie Hime

Gemma Norrington-Davies & Dr Ilka Weissbrod

June 2018

Acknowledgements

The review team would like to thank the Steering Committee for their thoughtful and constructive inputs, and Catherine Harbour and her team at CIFF for their on-going support and inputs. Thanks to the original commissioner of the review, Megan G. Kennedy-Chouane. Thanks to Samantha Smith, Director at the Just Transition Centre for her helpful comments. Any errors remain the authors' own.

Steering Group: Corina Campian, Catherine Harbour, Hongpeng Lei and Tom Lorber at CIFF; Keith Allot at ECF; Alvin Lin at NRDC China; and Andrzej Blachowicz at Climate Strategies.

Copyright permissions

Lessons for a successful transition to a low carbon economy by [Lucy Stone & Catherine Cameron](#) is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](#).

Based on a work at www.agulhas.co.uk.

To view a copy of the license, visit <https://creativecommons.org/licenses/by-nc-sa/4.0/>



Contents

Glossary of terms and acronyms	iii
Executive summary	iv
Introduction.....	iv
Methodology and evidence gaps.....	iv
Case studies.....	v
A typology of interventions	vi
Conclusions.....	vi
Recommendations for grant makers	viii
Recommendations for policy makers	ix
1. Introduction	1
2. Methodology.....	7
3. Gaps in the evidence	9
4. The impact of poorly managed transitions	11
4.1 Job loss and unemployment.....	11
4.2 Health and social issues.....	14
4.3 Adverse economic impacts.....	15
5. How to manage the transition to a low-carbon economy.....	17
5.1 Financial compensation for workers.....	21
5.2 Job retraining and skills development	22
5.3 Infrastructure regeneration projects	23
5.4 Regional support schemes to promote economic diversification.....	24
5.5 Stakeholder/Civic Forums for participation and dialogue.....	28
6. Conclusions	32
7. Recommendations for grant makers	34
8. Recommendations for policymakers	36
Annex 1: Case studies	0

Bibliography	5
Case studies: by country	5
Case studies: global	13

List of Figures

Figure 1: The three stages of climate transformation	6
Figure 2: Workers laid off in China in 1999 by region.....	12
Figure 3: EU potential CO ₂ emissions from existing and planned coal capacity against least-cost pathways	13
Figure 4: A comparison of the relative labour intensity of different sectors of the European economy	14

List of Tables

Table 1: Range of literature reviewed.....	8
Table 2: Elements of the typology against the five case studies	31

Glossary of terms and acronyms

Term/Acronym	Definition
ARC	The Appalachian Regional Commission
CIFF	The Children's Investment Fund Foundation
E3G	Third Generation Environmentalism
ECF	European Climate Foundation
ETUC	European Trade Union Confederation
EU	European Union
FTSE 100	The Financial Times Stock Exchange 100 Index
IDDDRI	The Institute for Sustainable Development and International Relations
ITUC	International Trade Union Congress
NRDC	Natural Resources Defense Council
UNFCCC	The United Nations Framework Convention on Climate Change

Executive summary

Introduction

In order to reduce carbon emissions at the rate required by the Paris Climate Agreement policymakers have recognized that transformative structural change is needed, across all economies. This change will have to happen at unprecedented scale and speed. All 195 signatories to the Paris Agreement have accepted that specific measures are required if it is to take place.

The challenge for policy makers is how to enable this transition and manage the impact on individuals and communities.

Economies are not static; history provides ample demonstration that economies have always changed and evolved – sometimes abruptly in response to external shocks and sometimes in planned steps in anticipation of changes in technology or global trends.

In many countries the transition to a low carbon economy is already underway or is on the horizon. It is not always driven by climate policy. Concerns about the impacts of pollution on health and productivity, or the opportunity to boost economic competitiveness from electric vehicles and renewables, are examples of other drivers of transition. Governments and society are seeking lessons not only to manage the negative impacts of the transition, but also to harness the many benefits.

Transition measures can become the mechanism for workers and communities to speed the exit from a carbon economy, by calling for and engaging in alternative livelihoods. The right structural policy, along with support for communities and workers to plan for the transition, can mitigate negative social impacts, stimulate alternative livelihoods and pre-empt a backlash against such change.

Methodology and evidence gaps

This assessment provides a high-level summary informed by a broad literature review that sought to identify common themes in managing industrial transitions across 26 countries and 11 sectors.¹ The aim was to create a picture of the available evidence and the evidence gaps, and to identify the best examples of transition management.

Transitions have been taking place across different countries since the start of the industrial revolution. Much of the literature relevant to low carbon transitions focuses on the decline of

coal mining, we found that while there are a few examples of well-managed coal transitions, most coal closures are examples of poorly managed transitions. Evidence from these examples of success tends to focus on the macroeconomic and overall job figures rather than on broader social impacts and improvements.

There are few other sectors and economies that have successfully completed a transition to a low carbon economy, although there are numerous efforts under way which are still too early in the process to evaluate. Given this data gap we broadened our literature review to identify other additional illustrative case studies, alongside the five case studies that had a solid evidence base.

There is weaker evidence on the health and social improvements of well-managed industrial transitions and, until recently, poorer evidence on how well managed transitions can have positive impacts beyond job protection/creation. This is largely because the focus on 'transition' has been about mitigating the negative job loss rather than about harnessing change for broader benefit. There is much anecdotal evidence to suggest some broad and deep positive impacts, often with ripple effects across economies, but less independent, robust assessment beyond figures about job creation. There is a geographical evidence gap, with an obvious focus on more mature post-industrial economies and much less evidence from middle-income countries currently engaged in transition.

Case studies

We selected five case studies from a range of examples of the transition away from carbon intensive industries towards cleaner energy sources. Some recent literature by the Institute for Sustainable Development and International Relations (IDDRI) and Climate Strategies has looked at lessons on managing coalmine closures. We went beyond coal to include case studies from other sectors in order to add to this body of evidence. These best examples were selected to illustrate a range of interventions utilised by different actors. We tried to identify the case studies that were for relatively fast transitions given the current time pressure for low-carbon transition.

1. Spain: Revitalising Metropolitan Bilbao
2. North East England: Fostering entrepreneurship in low-carbon technology
3. China: Heavy industry to high-tech transition in Shenyang City
4. Germany: Lignite mining to tourism in Lausitz
5. Scotland: Putting the enabling framework in place for transition

A typology of interventions

The review identified a number of key enablers. The successful management of economic transition requires a package of measures under a broader structural policy approach. This includes economic diversification or stimulation to ensure long-term sustainability. Our review identified a typology of interventions that have been utilised, often in concert, to manage transitions:

1. Early retirement/pension/financial compensation for workers
e.g. In Shenyang, China the central government allocated c.\$15bn as an aid package to fund retraining, early retirement and the creation of new public sector jobs
2. Job retraining and skills development
e.g. in Lausitz, Germany the central government created a regional management company which provided 20 000 new jobs for the workforce in decontamination and environmental clean-up
3. Infrastructure regeneration projects
e.g. In Bilbao, the Government of Spain's investment in state of the art transport infrastructure and reorganising the public space was the key to transforming a post-industrial area in decline into a popular and thriving tourism industry.
4. Regional support schemes
e.g. In the North East of England a regional support facility was set up investing in five universities in the region to build enterprise capacity. These in turn created new skills, jobs and businesses.
5. Forums for participation and dialogue
e.g. In Connecticut, USA a citizen advisory committee was set up to ensure the local community had a say in the future of the area post the closure of a coal mine.

Conclusions

This assessment explored how transitions can be better planned for, managed and delivered. The examples identified show the possibility not just of mitigating the worst impacts on workers and communities, but the economic and social opportunities that a well-managed transition brings to regions and economies.

The report has developed a typology of the interventions that can be combined to enable a successful transition. These can be applied across any sector or country. The key is in combining the elements at the right time and with enough support. This support is more than

simply one-off financial transaction in the form of redundancy payments, but is structured long-term support for the workers and the community in that region. There are examples of how this has been successfully applied in relatively short time periods (5-10 years) but all transitions are ultimately a long-term evolving plan.

It is not enough simply to support workers who lose their jobs during a transition. The broader community, often providing services and ancillary businesses also needs support, for example with cluster policies to support a particular sector or regeneration and diversification of a region. This is vital to prevent long-term inequality and area decline.

Some sectors will potentially see an overall net increase in job creation, for example in automotive electrification and energy generation, however this cannot mask where there is inevitable job loss. Some workers will not be able to easily move jobs, or relocate or reskill, and so plans need to be in place for due warning, preparation and financial support. Where redundancy payments were combined with retraining packages, these were more effective than higher total redundancy pay.

Where governments plan in advance for the low-carbon transition, ensuring education and training are suited to future and evolving low-carbon economies, and regions are supported in diversifying their economies, the negative social and economic impacts are avoided *and* the economy is being positioned to capitalize on the low-carbon transition. Such action can promote transition at the speed and scale required, triggering similar measures elsewhere. Managing low-carbon transitions needs to be contextualized to include the wider transition agenda for the future of work, including the broader technological trends, for example in automation and manufacturing.

Stakeholder dialogue is a critical success factor. This includes more formal social dialogue between workers and their unions, employers, and often governments, as well as broader stakeholder processes involving communities and civil society. Both the broader process of stakeholder dialogue, and social dialogue, help to ensure buy-in and transparency, preventing backlash and generating support for the process, not just by the workers who face redundancy but by the impacted broader community, for example the ecosystems of supporting businesses that grow up around an industry, and the social fabric made up of schools, clinics, community centres and hospitals that face potential changing income levels (e.g. from declining industry tax contributions). As a result of union mobilization there are numerous examples of workers in highly polluting industries supporting a just transition to low carbon livelihoods and jobs and taking demands for transition plans into collective bargaining and other negotiations with employers and government. Similarly, community and civil society mobilization can provide the impetus for government planning for transition and investment. Stakeholder dialogue and social dialogue do not just involve consulting workers and communities, but ensuring their active engagement in the process of planning and implementing the transition.

Transition Funds can be used to ease the blow in the short term to prevent workers and their families falling into poverty or ill health, but to be most effective at facilitating a smooth and sustainable transition they must also build the capacity of workers and communities to make the transition on their own terms. This can involve retraining, redeployment and support for alternative livelihood diversification. Transition Funds that are not designed to accelerate a smooth transition risk being used to prop up the status quo, delay climate action, or shift the fiscal responsibility from companies to the state.

Transition to a low-carbon economy has the potential to add more value than simply reducing pollution. Transition policy can create dynamic, inclusive, healthy regions, with better work opportunities and thus provide a source of regional prosperity and pride. The obligation to address climate change creates an opportunity to design climate policy in a way that can deliver a source of community regeneration and renewal, rather than just preventing loss. Well-managed transitions can result in a revitalization of a region, with enhanced prosperity and well being by moving away from 'economic lock-in' from high carbon industry.

Recommendations for grant makers

Recommendation 1:

Grant makers should develop a strategy that incorporates a set of principles and practical applications for managing transition within both sector and country climate change programmes. These can be achieved by enabling policies and tools put in place by partner governments or facilitated by grantees. This could include a suggestion to all relevant grantees to consider designing in transition strategies. For example:

- a) development of screening protocols to identify ways to design out potential negative social impacts of climate policies;
- b) identification and articulation of the co-benefits to be derived;
- c) establishment of budget lines for advocating transition policy measures.
- d) Grant makers could also consider publishing a range of advocacy products to support government policy design.

Recommendation 2:

Stakeholder dialogue has been shown to be a critical tool to create and enlarge the space for facilitating the transition – creating public support for increasing climate ambition, preventing backlash and enabling co-design of climate policy. This includes more formal processes of social dialogue between workers and their unions; employers; and governments, which has

proven to be key in negotiating the work, economic and social aspects of transition, and securing the support of the world of work.

Governments are not always best placed to pay directly for or facilitate stakeholder participation and dialogue, but they are dependent on this to be in place in order to accelerate the low carbon transition. In social dialogue, by contrast, governments can play a key role in convening the parties.

Stakeholder dialogues can be created and facilitated by unions, civil society organisations or independent facilitators, who can enable an honest dialogue about the work and community impacts of transition, and help plan for the future. Social dialogue is convened and carried out by unions, employers, and governments, who may also decide to include other actors in the process.

Almost all of these require grants, and so this is a critical role for grant makers.

Stakeholder dialogue and social dialogue potentially enables faster, more successful and more just low carbon transition and so they are an essential element of the grant makers' toolbox to manage change and deliver climate goals.

Recommendation 3:

Given the relative paucity of information on how to ensure successful transition relevant to middle-income countries, grant makers could commission primary research to identify policy case studies that are relevant to the transition in key middle-income countries, for example in China, India, Indonesia and South Africa.

Delivering more primary research, particularly focusing in on the wider social impacts, and interviewing the workers themselves rather than relying on general job figures, will further support the case for a transition to a low-carbon economy.

Recommendation 4:

Having identified a typology of successful interventions, grant makers could commission further research to test this and to identify whether there are particularly important sequencing issues or optimal levels and types of intervention.

Recommendations for policy makers

Recommendation 1:

Policy makers need to factor in transition measures alongside climate policies since the government policy response can significantly affect the outcome of transition. A proactive fiscal or policy approach to sectors and regions that stand to be most affected by the low-

carbon transition will enable them to become more productive and prosperous, contributing to economic and social development.

Specific transition measures can complement the national policy approaches. These measures may include regional funding and policy to support economic diversification, targeted infrastructure investment, training and education, social protection, and ensuring adequate pension and redundancy provision.

Recommendation 2:

Policymakers should find ways to support the participation and dialogue process given that communities and their representative organisations (such as unions, faith and community groups) have a critical role in discussing, co-creating and then implementing the transition vision.

With communities and workers engaged in the transition, the whole process can be accelerated. Without this support there is potential for backlash that can slow down or disrupt the transition process.

Specific government established Transition Funds can also provide grants to create the capacity and resource for communities, businesses and workers to proactively accelerate the move away from fossil fuel-based jobs and industries, rather than to just adjust to decline.²

Recommendation 3:

Government intervention may be required to ensure that businesses make a contribution to the costs of transition proportionate to their impacts. Heavy polluting industries have a responsibility to pay for the costs required for the transition to low-carbon economies, and often do either voluntarily and directly, or involuntarily or indirectly. However some companies may opt to go bankrupt, or foreclose, without fulfilling their financial or environmental obligations to the workers or local community. Companies can be required by governments to make payments into specific Transition Funds, for example, or payments for specific measures such as land restoration and clean-up, and/or towards pensions and redundancy for workers.

1. Introduction

A transformative structural change across the world's economies and societies is required at an unprecedented scale and speed in order to reduce carbon emissions at the rate required to meet the Paris Climate Agreement.

Economies are not static – they have always transitioned and evolved. Transitions happen for many reasons, sometimes planned and sometimes in response to economic, political or other shocks.

History teaches us that economies have long dealt with shocks, both sudden and slow-build. We see that economies change – from tulip mania in Holland in 1637 to the Gold Rush in the USA in the 1850s, and the recent more widespread dot.com and housing bubbles from 1995-2008. Transition and evolution is normal – whether abrupt or slow burn. In the 23 years since the FTSE 100 was launched only 28 of the original 100 companies have survived on the list.³ The climate transition is therefore not a new occurrence, but it is an imperative. Whether these changes have long-term negative impacts or not depends on how well the key actors involved proactively prepare and manage the process. The transition towards a low carbon, sustainable economy, as with any transition, needs careful management to ensure it delivers.

Disruptions are already starting to occur in a wide range of sectors including energy, urban infrastructure, transport, heating and agriculture. These require economy-wide transformational plans and reforms to manage and accelerate the low-carbon transition. The phase out of fossil fuels is occurring already, partly as a result of climate policy and social pressure; partly because it is becoming a less competitive source of energy as the cost of renewable energy continues to rapidly decline and battery storage technology improves. Growing awareness of the adverse health impacts of pollution are also helping to accelerate the transition away from fossil fuels.⁴

In many economies these transitions are already underway. Governments are looking for ideas to manage the negative impacts on fossil fuel-based jobs and communities, and also to reap the potential rewards from a low-carbon transition.

The European Trade Union Confederation (ETUC) has called for a 'Katowice Plan of Action for a Just Transition' to be adopted at COP 24 in Poland in November 2018.⁵ Scotland is in the process of setting up a Just Transition Commission, having launched a Transition Fund in 2016 to support workers losing their jobs in the declining oil sector. The Canadian government has committed to phasing out coal-fired electricity by 2030 and to support the involvement of

⁴ *Fuelling Europe's Future: How transition from oil strengthens the economy*, Harrison P, 2018, [link](#).

⁵ *ETUC deploras slow progress and calls for 'Katowice plan of action for Just Transition' at COP 24*, ETUC, [link](#).

workers in the transition to the low-carbon economy with a 'Just Transition Task Force'. To support the transition, the government intends to use an additional C\$21.9bn (equivalent to US\$17bn and £12.6)⁶ over 11 years for green infrastructure and commercially viable clean energy, including funds flowing through the Canadian Infrastructure Bank. The Chinese government is looking at ways to further manage job loss with the closure of coalmines and other heavy industry responsible for air pollution and climate change.

The idea that a well-managed transition is one that ensures people are the beneficiaries and not left as stranded communities dates back to the 1990s. The term 'Just Transition' was popularized by the US labour union leader Tony Mazzocchi in the 1990s. He argued for the creation of a 'superfund for workers' to provide support and opportunities for workers displaced by environmental policies. He said that:

*"Paying people to make the transition from one kind of economy – from one kind of job – to another is not welfare. Those who work with toxic materials on a daily basis in order to provide the world with the energy and the materials it needs deserve a helping hand to make a new start in life."*⁷

Over time 'Just Transition' came to mean something broader for unions and their partners: 'A deliberate effort to plan for and invest in a transition to environmentally and socially sustainable jobs, sectors and economies. As understanding of the climate crisis grew, unions began to tie Just Transition specifically to action on climate change. They also began campaigning to insert Just Transition into international regimes, including the United Nations Framework Convention on Climate Change (UNFCCC) negotiations.'⁸

Growth in low-carbon markets, for example in e-mobility and renewable energy, presents significant potential for new jobs and growth in gross domestic product (GDP).⁹

A report by the European Climate Foundation (ECF) on the impacts of the transition to clean mobility in Europe showed that the transition to electric and hydrogen vehicles will create new jobs in manufacturing and installing the charging infrastructure, as well as the growth of renewable energy required.¹⁰ But it will also reduce jobs in manufacturing combustion engines and the petrol or diesel required to power them. The analysis shows that employment in the automotive sector will remain stable until 2030, after which the structural changes will mean potential job losses, for example uncertainty about potential locations of battery

⁶ xe.com [accessed 18/04/18]

⁷ "Just Transition" - Just what is it? An analysis of language, strategy and projects, Labor Network for Sustainability and Strategic Practice: Grassroots Policy Project, 2016, p.6, [link](#).

⁸ Just Transition: A Report for the OECD, The Just Transition Centre and International Trades Union Confederation (ITUC), 2017, [link](#).

⁹ Fueling Europe's Future, Harrison P, 2018, *op. cit.* p.1.

206,000 net additional jobs estimated in e-mobility in Europe alone and the implementation of fuel efficiency measures for cars will increase net GDP in Europe.

¹⁰ *Ibid*

manufacturing and whether that will be within reach of former or prospective employees relocating. This means there is time to plan in measures to manage this transition within the mobility sector – calibrating the education and training for students and workers to the future markets for example, or ensuring that there is investment in alternative livelihoods in areas with high dependency on manufacturing traditional combustion engines and associated jobs.

Transition in the coal sector is under a faster timescale, which in some cases means closing coal stations currently in operation, or halting planned developments. This requires a more proactive plan by the companies, governments, unions and workers. There are some inevitable job losses implied by the need to accelerate the transition to a low-carbon economy in some sectors, whilst in other sectors job losses can be mitigated by building in transition measures into the process.

There are broader trends, such as acceleration of automation that potentially pose a much greater impact on jobs than climate policy, for example automation of cars and energy processes.

This means national plans for a low-carbon transition need to incorporate a broad view of the future of work and ensuring current and future workers are prepared for the fast evolution towards increased automation and artificial intelligence as well as climate resilient economies. A 2013 study of the types of employment exposed to job loss risk by automation estimated a total of 47% of workers in the US had jobs at high risk of automation. Historians and economists point out that technological advances have always been accompanied by job loss concerns, from industrialization to the introduction of computers, and often the overall pattern is for new jobs created from new products and services attached to the new technological advances rather than a net overall loss.¹¹ The key lesson here is that transitions need to be managed so that individuals, families and communities do not have to bear the brunt of the transition, but are supported to adapt to the ever evolving economy. This applies to any transition, whatever the driver.

Communities, workers, civil society organisations and politicians are often keen for alternative sources of income, less detrimental to their health and well-being and less dependent on fluctuations in oil price, but with similar or higher levels of income and status.

In Canada, former and current oil sands workers have grouped together to create an initiative to reskill in renewable energy – citing multiple reasons to transition out of oil sands industries including job insecurity, redundancies and the nature of the work that takes workers away from families for periods of time.¹² In Port Augusta, South Australia, workers at a coal-fired power station were worried about losing their jobs as plants were closing, and local residents

¹¹ *How computer automation affects occupations: Technology, Jobs and Skills*, Bessen J, Boston University School of Law, Law and Economics Research Paper No. 15-49, November 2015, [link](#).

¹² *Facing uncertain future, fossil fuel workers want retraining in renewables*, Voysey, The Conversation, 2017, [link](#).

were worried about air quality and environmental health. The workers and local residents called for a clean energy transition in their area, and identified a solution in developing a solar thermal plant and found companies interested in supporting the transition.¹³ In New York in 2018, a new partnership was announced between Bloomberg Philanthropies and the Powering Past Coal Alliance (co-founded by Canada and the UK in 2017, now with over 50 countries, regions and businesses signed up) to accelerate the global phase-out of coal by providing global leaders with targeted information. The alliance will identify techniques, tools, strategies and tactics to support this transition.¹⁴

Well-managed transitions can result in a revitalisation of an area, rather than just preventing high unemployment and finding alternative employment for workers.

Transitioning can result in a shift away from the monopoly of one industry in an area to multiple, diverse sources of employment, thereby eliminating a major source of air and water pollution, improving the health of residents and producing a more resilient economy. A local area can find a whole new identity and pride. Economic lock-in, where most firms in an area are directly linked to a dominating industry, paralyses entrepreneurship, innovation and flexibility. A transition to low carbon, if well managed, can have a positive transformation on the health and well-being of whole communities.

Guidelines on achieving a Just Transition are already available.

In 2015 the International Labour Organization published *Guidelines for a Just Transition towards environmentally sustainable economies and societies for all*. These state that transition needs to be well managed and contribute to the goals of decent work for all, social inclusion and the eradication of poverty.

“Managed well, transitions to environmentally and socially sustainable economies can become a strong driver of job creation, job upgrading, social justice and poverty eradication. Greening all enterprises and jobs by introducing more energy and resource-efficient practices, avoiding pollution and managing natural resources sustainably leads to innovation, enhances resilience and generates savings which drive new investment and employment.”¹⁵

These guidelines usefully establish guiding principles, including the need to establish strong social consensus and policy coherence. They recognize that there is no ‘one size fits all’ approach. The framework establishes a role for government in ensuring policy coherence, for governments and social partners to promote cooperation, share knowledge and best practice and to mobilize funding, support and assistance. It establishes the importance of stakeholder

¹³ *Port Augusta can show the world what just transition for workers looks like*, Guardian, 2016, [link](#).

¹⁴ *Bloomberg Philanthropies announces partnership with Powering Past Coal Alliance to strengthen global efforts to phase out coal*, Bloomberg.org, 9 April 2018, [link](#).

¹⁵ *Guidelines for a just transition towards environmentally sustainable economies and societies for all*, International Labour Organisation (ILO), 2015, [link](#).

and tri-partism policies. Just Transition needs to be integrated into macro-economic and growth policies, including industrial, enterprise and sector policies. Skills development, active labour market and social protection policies are required. The ambition is to have a transition standard in place by 2020.¹⁶

This report sets out to describe key ways in which the low-carbon transition can be managed.

The scope of the work was primarily to focus on managing job loss and the role of governments, but clearly there are broader transition issues to consider such as the change in ownership structures of the energy system and the question of who pays for a transition. The evidence points to the multiple roles required by different actors – from civil society, workers and unions, business and industry, and all levels of government from local, city to national. We therefore broadened the literature review to capture some of this. The scope of the review was about mitigating the impacts, rather than identifying and measuring the many economic, social and environmental benefits from a low-carbon transition, although we have identified where actions in mitigating job loss can reap further, broader co-benefits.

We have reviewed examples of successfully managed transitions and the key policy and programme solutions that could be deployed, such as retraining workers, pension schemes and economic diversification. The research shows that measures to manage transition have tended focus on national policy measures, but that the role of communities, workers and stakeholder dialogue has a critical role to play which may not be delivered by national policy or by specific programmes.

The EU and 175 states have committed to making a Just Transition

The preamble to the Paris Climate Agreement requires that government signatories of the Agreement will work ‘taking 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’.¹⁷

Whilst some countries are still at the initial stages of climate transition, Europe and China are now moving into a deeper, more structural change stage of climate transition. An independent sustainable development organisation, Third Generation Environmentalism (E3G), describes the three stages of climate transformation in Figure 1.¹⁸

¹⁶ *Ibid.* Note that Annex 1 helpfully includes a list of labour standards and resolutions that may be relevant to a just transition framework.

¹⁷ *Just transition of the workforce, and the creation of decent work and quality jobs*, UN Framework Convention on Climate Change, 2016, p.50, [link](#).

¹⁸ *Input Paper for the OECD Key Political Economy and Entanglement Issues of the Low-Carbon Transition in G20 Countries*, Mabey et al., E3G, Mabey et al., 2017, [link](#).

The Three Stages of Climate Transformation

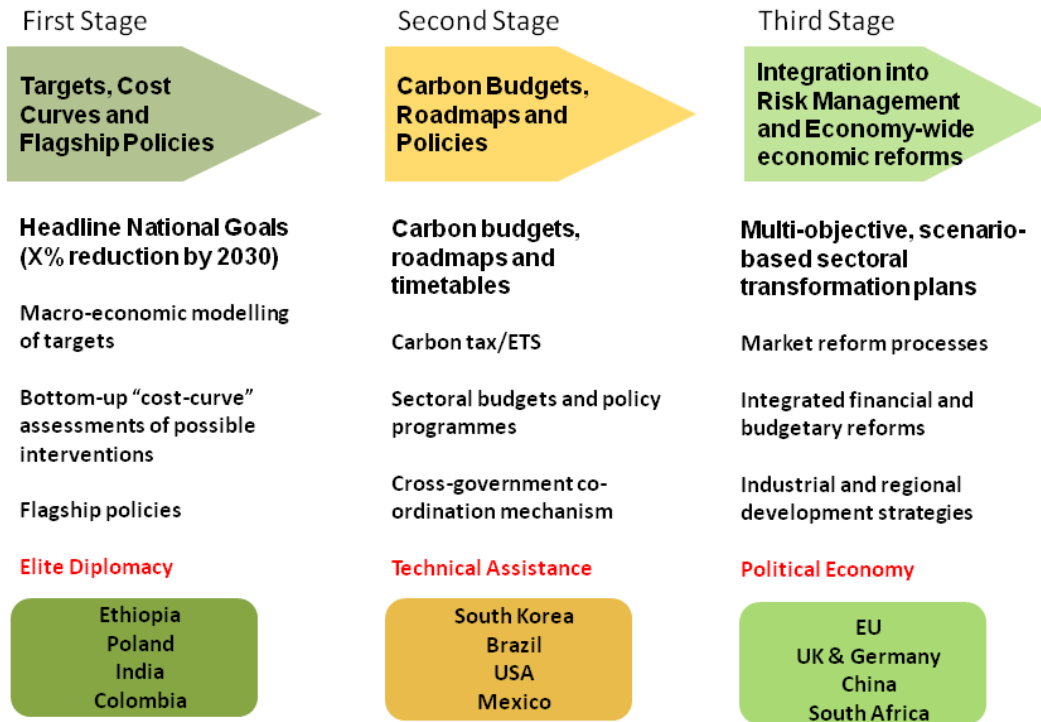


Figure 1: The three stages of climate transformation

2. Methodology

This report is informed by a broad literature review that sought to identify common themes in managing industrial transitions.

Since there are no countries that have completed a transition to low carbon, and many are just starting, we looked beyond fossil fuel-based industrial transitions to include other sectors. A study conducted in 2017 by the Institute for Sustainable Development and International Relations (IDDRI) and Climate Strategies looked at historical coal transitions that occurred largely as a response to global market pressures rather than climate policy.¹⁹ This concluded that most of these examples were not proactive transition management and largely serve as examples of what not to do, rather than best practice. The research concludes that there is a need to analyse actively planned industrial–regional transitions and their factors for success. This is what our research and this report seek to do.

A wide body of literature on industrial transition was consulted, both to create a picture of the available evidence and the evidence gaps, as well as to identify the best examples of transition management.

The ‘Coal Transitions’ project work by IDDRI and Climate Strategies referred to above has looked at lessons on managing coal closures and we have included these in our review. We have also identified case studies from beyond coal in order to add to this body of evidence. There is also recent work on the case for a European transport transition away from oil towards zero emissions vehicles.²⁰ The following examples were selected to illustrate a range of interventions utilised by different actors.

1. Revitalising Metropolitan Bilbao, Spain
2. Fostering entrepreneurship in low-carbon technology, North East England
3. Heavy industry to high-tech transition in Shenyang city, China
4. Lignite mining to tourism in Lausitz, Germany
5. Scotland: Putting the enabling framework in place for transition

¹⁹ *Lessons from previous ‘Coal Transitions’: High-level Summary for Decision-makers*, Caldecott, Sartor and Spencer, IDDRI and Climate Strategies, June 2017, [link](#).

²⁰ *Fuelling Europe’s Future*, Harrison P, 2018, *op cit.* p.1.

We also identified a number of other managed transition examples which we have included in this report. Table 1 shows the range of literature we reviewed to identify key trends and lessons.

Table 1: Range of literature reviewed

26 countries	Range of authors	11 sectors
Bangladesh Cambodia Canada China Czech France Germany Hungary India Indonesia Italy Korea Netherlands New Zealand Peru Philippines Poland Russia Rwanda Slovenia South Africa Spain Sri Lanka Sweden UK Ukraine USA	<ul style="list-style-type: none"> • UN bodies • Government agencies and commissions • Research organisations and think-tanks • Universities • Energy agencies • Trade unions • NGOs • Campaign networks 	<ul style="list-style-type: none"> • Automotive • Aviation • Coal • Fisheries • Forestry • Gas • Manufacturing • Oil • Shipbuilding • Steel • Textiles

3. Gaps in the evidence

Industrial transitions have been taking place across different countries since the start of the industrial revolution.

We have focused on the transitions since 1970 to ensure relevance, and have found the most examples in highly developed countries where heavy industry has been in decline and transitions towards service and knowledge economies are already underway. However, there is a surprising lack of policy focused literature on the topic of transition policy, and much of it has to be drawn from other literature – on economic regeneration policy for example and applied to climate change policy.²¹

There is a geographical evidence gap.

Some areas, such as the Ruhr Valley in Germany, a coal-mining region, have been heavily studied. There is also a range of literature on other industrial transitions in developed countries, since there are clearly going to be more examples of transitions away from heavy industry in more advanced economies. Unsurprisingly, there is less evidence from emerging economies.

There are some well-documented case studies of coal transition.

Aside from the Ruhr Valley in Germany (and coal in Netherlands) – often cited as a good example of a managed regional transition – most of the other coal transitions are lessons in poor management. Very often it is not possible to truly assess the results of a transition until a decade after the plant or mine closure, and so many are currently too premature to judge. Where coal closures have taken place some 10 or 20 years ago, there is often little measurement or analysis of government expenditure to manage closure, or a suitably robust assessment of the efficacy of this support.²²

Most of the evidence on industrial transitions looked at the success or failure of policy implementation in terms of the industry impacts and overall job loss.

Much of the research is focused on the employment rates and macro-economic trends and sometimes the environmental assessment such as land restoration, but it does not give detailed insights into the social impacts such as poverty rates, or family and child well-being.

²¹ <https://coaltransitions.files.wordpress.com/2018/05/transition-policy-for-climate-change-mitigation-2.pdf>

²² Caldecott *et al.*, *op. cit.* p.9.

There is also a lack of evidence of how the workers themselves felt about the transition process, aside from whether they were able to find new jobs or accept redundancy. There are very few examples of workers interviewed or questioned about how they felt about a transition. This should be a priority for further research and indeed in the design and implementation of policy.

Given the lack of robust evidence, to have truly analysed the effectiveness of transition measures we would have had to conduct our own original research, interviewing previous workers and residents, which was beyond the scope of this work. However, we consulted a broad enough range of examples to be able to draw out patterns and lessons of elements of success in managing transitions.

4. The impact of poorly managed transitions

There is a good body of literature on the decline of coal mining.

The literature shows that as this decline has played out over many decades across Europe and the US, driven largely by the growth of more efficient sources of energy and cheaper coal imports, negative impacts can last for generations when the decline is poorly managed or not managed at all.²³ The impacts do not just include the workers who lose their jobs and income, but also their families, and the broader local and regional economy that had grown up around the industry. A whole town or region can become depressed with a negative spiral of impacts rippling through the community that can take many decades and significant, sustained investment to overcome. We have seen this in former coal mining regions in Eastern Kentucky in the US and in other sectors, for example the collapse of the car manufacturing industry in Detroit, US.²⁴

4.1 Job loss and unemployment

High carbon industries such as coal mining tend to be a dominant employer in a locality and so when they disappear it can create very high levels of concentrated unemployment, unless alternatives have already been developed in advance of that industrial closure. Older and lower skilled workers can find it especially hard to find new employment.

In Germany, previous coal industry employees found it more difficult to find new jobs than employees from other industries. For example, in the Lausitz region, previous coal industry employees over 50 years old on average remain unemployed for 15.8 months compared to those under 30 years old who stay on average unemployed for 2.9 months.²⁵ Due to limited alternative employment, recent graduates move away leaving an ageing population with high unemployment. Areas where fossil fuel industries have grown up, particularly in rural areas, provide limited educational opportunities for workers with fewer skills to retrain.

The scale of job loss can be large and sudden in some sectors:

In Lausitz, Germany, employment in the lignite industry reduced from 80,000 people in 1990 to around 7,000 in 2000.²⁶ In China, the number of coal mine workers laid off will only increase

²³ *ibid.*

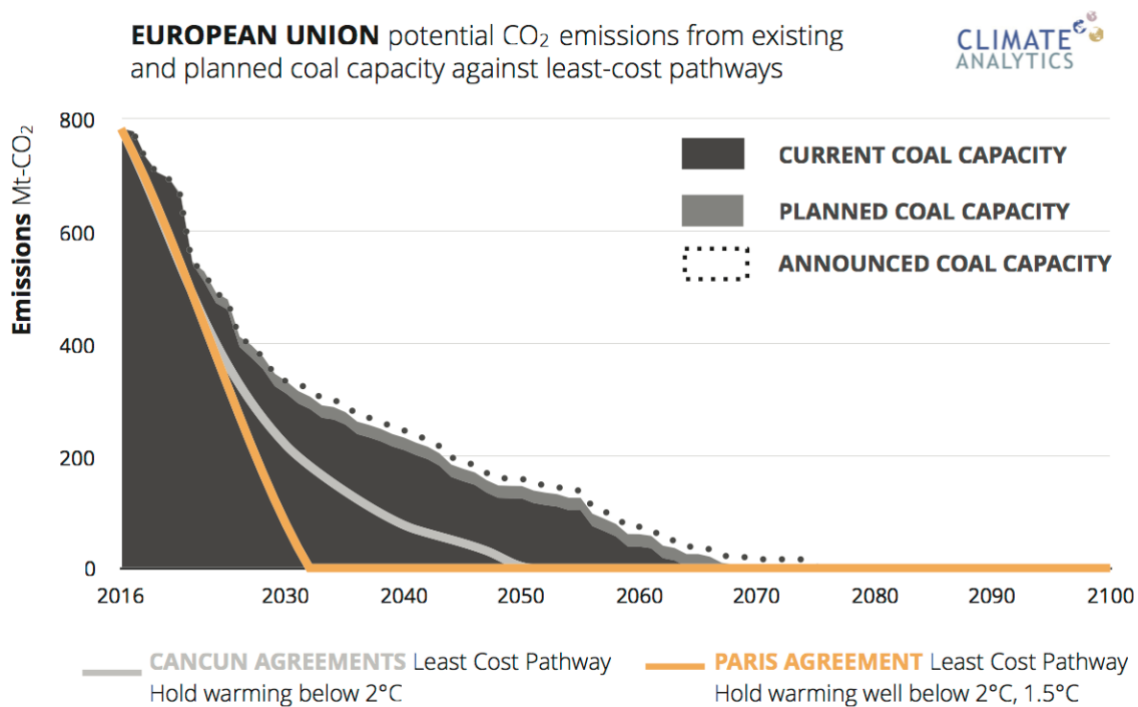
²⁴ *Coal Transition in the United States*, Irem Kok, IDDRI and Climate Strategies, 2017, [link](#).

²⁵ *Arbeitsplätze in der ostdeutschen Braunkohle: Strukturwandel im Interesse der Beschäftigten frühzeitig einleiten*, Franke, Hackforth and Haywood, DIW Berlin — Deutsches Institut für Wirtschaftsforschung, 2017, p.3, [link](#).

²⁶ *Structural Change in Lusatia: What Will Come After Lignite?* Schwartzkopff and Schulz, E3G, 2015, [link](#).

as China meets its climate and pollution targets.²⁷ China plans to close 4,300 coalmines by 2019. It has allocated ¥30bn (c. US\$4.7bn; £3.5bn) from 2017 to 2020 to support the closure of small and inefficient coal mines and redeploy 1 million workers. This may seem substantial, yet analysts estimate that the total required to tackle overcapacity in the coal and steel sectors could reach ¥200bn (c. US\$31.4bn; £23.2bn), 70% of which would be needed for coal.²⁸

Across the EU, the amount of coal capacity phase-out required to meet climate targets by 2030 is shown in Figure 2.²⁹ This Climate Analytics report found that replacing coal with renewables would have significant social repercussions for coal mining. In Europe in 2014, 177,000 people worked in coal mining, more than half of them in Poland. However, the increasing demand for alternatives to coal is creating a greater number of jobs in the renewables sector. In 2014, over 1.1 million people were already employed in the renewables sector. Due to the higher employment intensity of renewables compared to coal, this will provide more jobs than will be lost as a result of coal phase-out. The distributed character of renewables will also enable more balanced development across different regions.³⁰



²⁷ *Managing the political economy frictions of closing coal in China*, Smith School of Enterprise and the Environment, Caldecott et al., University of Oxford, 2017, [link](#).

²⁸ *Just Transition - Where are we now and what's next? A Guide to National Policies and International Climate Governance*, International Trade Union Confederation, 2017, [link](#).
Currency conversions from xe.com, [link](#). [accessed 17/05/2018]

²⁹ *A Stress Test for Coal in Europe under the Paris Agreement: Scientific Goalposts for a Coordinated Phase-Out and Divestment*, Climate Analytics, 2017, [link](#).

³⁰ *ibid.*

Figure 2: EU potential CO₂ emissions from existing and planned coal capacity against least-cost pathways³¹

...whilst in other sectors it is possible to plan ahead.

Different sectors face decarbonisation at different rates and so job loss can be prevented with preparation and policy, especially around ensuring the right skills are in place ahead of time. For example, in the automobile industry, although there is a level of uncertainty about predicting potential future job losses, and there is a trend towards automation of the auto industry that will also contribute to job losses, overall the evidence points to a net increase in jobs.³² Building electric vehicles is generally less labour intensive than diesel or petrol cars, but hybrids and hybrid electric vehicles are more labour intensive. For example, the role-out of electric vehicles creates jobs in the charging infrastructure, and net increases in employment are also predicted in construction, electricity, hydrogen, services and manufacturing. Although the evidence points to an overall net positive effect on jobs in the low-carbon transition of the automotive industry, care will need to be taken of those who will lose their jobs in technologies that are superseded. Further analysis is required to identify how best to achieve a 'Just Transition' in the auto sector within the broader context of increasing automation.³³

³¹ *ibid.*

³² *Fuelling Europe's Future*, Harrison P, 2018, *op cit.* p.1.

³³ *ibid.*

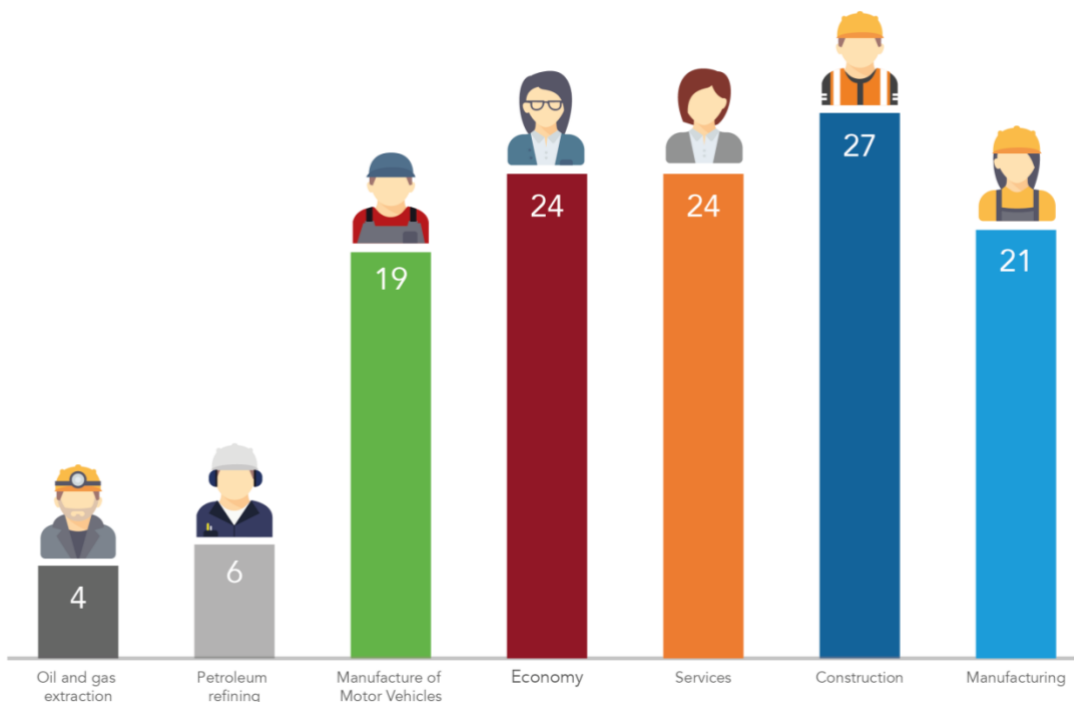


Figure 3: A comparison of the relative labour intensity of different sectors of the European economy³⁴

4.2 Health and social issues

The literature on coal transitions shows that for those workers who manage to find alternative jobs, these can involve longer commutes, which has a negative impact on families and the individual worker. Alternative employment is very often with lower pay and/or unfavourable working conditions, creating lower household incomes for families and more associated health and child development issues. Replacement jobs can also be more precarious work and shorter contracts, creating higher stress and uncertainty for individuals and their families.

“The disappearance of jobs in coal and health issues are interrelated in Appalachian coal communities. Poverty rates were already high in the glory days of the coal industry. Following coal closures, high rates of obesity, smoking, drug abuse, hypertension and heart disease all affect life expectancy. The lifespan in coal counties in Eastern Kentucky is 6 years shorter than national average. The state ranks among the bottom 10 in quality of life measures. In Beattyville, Kentucky, the poverty rate is 44% higher than the national average. More than half of households live below the poverty line.”³⁵

Community break-down is further exacerbated if workers are faced with the choice of relocating for new jobs or having to stay unemployed because of family dependencies (e.g. children in school, other jobs in household, or elderly parents), home ownership (especially if

³⁴ Source: *ibid.*

³⁵ *Coal Transition in the United States, op. cit.* p.11.

bought with a large mortgage and then those prices decline as the area declines), or other social ties. In Germany, frustrations with the lack of long-term transition measures to mitigate impacts of heavy industry job loss has been identified as a key factor in the rise of the far right in the former East Germany.³⁶ Areas where fossil fuel-based industry is the dominant employer have developed a strong cultural identity linked to this economic activity. Once this industry disappears, the local identity is affected. From the UK in the 1980s to the US in recent years, workers have found it psychologically hard to adjust to the loss of this identity.

“Particularly important issues for workers tend to be managing the risks of a loss of professional pride, socio-economic status, and personal identity that is tied to their wage level, professional responsibility and role in a specific company, the family and social networks are part of the economic life of the community. In general, the highest risk individuals are those between 35 and 45, who have personally invested in a specific career and who may have difficulty retraining and ‘beginning again’ in a new sector or geographical place.”³⁷

There is some evidence from the 1980s in the US showing how unemployment following a plant closure created increased stress not only on the employee, but also on their family. Evidence shows an increase in likelihood of violence in the family linked to unemployment increases, with family friction and tension as a result of unemployment, and the consequential negative impacts on children.³⁸

Fostering new identities with a sense of pride in the industries and sectors that replace the old closures is critically important.

This is illustrated in the examples given in the following section.

4.3 Adverse economic impacts

Poorly managed transitions can result in higher rates of unemployment, increased dependency on social welfare, poor health and growing poverty.

These in turn create an additional burden on the public budget at state and regional level.

The environmental clean-up, loss of tax revenue and high unemployment can put further pressure on local government.

In some more remote areas, the industry may have provided the infrastructure for the local community – roads, hospitals, housing and, in some cases, schools. As a result, the local authority struggles to maintain these services when the industry closes. This is an even greater

³⁶ *Was ist los mit dir, Ossi?* Gutsch, Der Spiegel, Issue 31, 2017, [link](#).

³⁷ Caldecott et al., *op. cit.* p.9.

³⁸ *The Impact of Unemployment on Families*, Broman, Hamilton and Hoffman, Michigan Family Review, Volume 02, Issue 2, pp. 83-91, 1996, [link](#).

risk in developing countries or remote rural areas, where local government may not have the capacity or budget to maintain the services.

Low-carbon transition means the closure of some industries or massively reduced capacity, whilst new industries and services grow or existing industries adapt.

Managing the transition extends beyond managing job loss to include fiscal management. Denial of the transition and failure to manage this can result in serious long-term impacts on *“specific regions often with high dependency ratios, low educational attainment, and poor health outcomes, below average wages and wage stagnation, and environmental problems related to site remediation. This often appears to be a legacy - at least in part – of a failure to anticipate and prepare for the transition.”*³⁹

An investment in low-carbon transition can result in these costs being avoided together with a more stable, prosperous regional future. It can prevent a far higher cost to the economy if not managed.

³⁹ Caldecott *et al.*, *op. cit.* p.9.

5. How to manage the transition to a low-carbon economy

The successful management of economic transition requires more than securing early pensions or alternative jobs for workers who lose their jobs as a result of the closure of high carbon industries. It depends upon a wider package of measures including economic diversification/stimulation to ensure long-term sustainability. This in turn would create higher resilience for other future transitions from other sectors and technological disruptions.

The Just Transition Centre pointed out that climate policies themselves could be instruments for enabling a positive transition, by creating new jobs and sectors. Denmark's energy sector is a good example of how the growth of the renewable energy sector, whilst phasing out coal, has created new jobs and industries with some 31,000 jobs in the wind industry alone.⁴⁰ However, it is not a simple case of replacing fossil fuel-based jobs with clean energy jobs. A broader structural policy approach is required.

A broader structural policy approach with complimentary policies is required.

This can include economic and social policy measures, regional and urban planning, education, employment and cultural policy, as well as energy and environmental policy.⁴¹ These diverse measures are working towards the common objective of mitigating the consequences of structural change and guiding it in a positive and sustainable direction.⁴²

Transition policies can incorporate the following measures:

- Public and private investment under long-term sustainable industrial policies to create green jobs and workplaces
- Compensation for climate protection
- Social protection – social insurance, income maintenance, job placement, secure access to health, energy, water and sanitation
- Training and education for new careers
- Wide consultation and stakeholder engagement
- Diversification⁴³

⁴⁰ ITUC, 2017, *op. cit.* p.2.

⁴¹ *Instruments for a Managed Coal Phase-Out: German and International Experiences with Structural Change*, Schulz and Schwartzkopff, E3G, 2016, [link](#).

⁴² *ibid.*

⁴³ ITUC, 2017, *op. cit.* p.2.

There is a broad range of projects and initiatives that have attempted to facilitate a fair transition, some initiated locally, some organized nationally or internationally. We have reviewed a diverse range of different initiatives, and have looked at transition programmes that have been introduced for a range of industries, more broadly than just in coal.

As highlighted in the introduction, 'Just Transition' was a phrase popularized by the labour union leader Tony Mazzocchi in the 1990s in the US to argue for the creation of a 'Superfund for workers' to provide support and opportunities for workers displaced by environmental policies. He argued that:

"Paying people to make the transition from one kind of economy – from one kind of job – to another is not welfare. Those who work with toxic materials on a daily basis in order to provide the world with the energy and the materials it needs deserve a helping hand to make a new start in life."⁴⁴

This Transition Fund was envisioned to be similar to the 'GI Bill of Rights' that provided education, training, home loans, farms and businesses, and unemployment pay for returning veterans following major wars.

A precedent in the US was a 'Worker and Community Transition Program' established by the Department of Energy in 1993 when the nation's nuclear weapons were downsized.⁴⁵ The program assisted workers to find alternative employment, economic recovery and diversification in affected communities. The programme encouraged communities to set up 'Community Reuse Organisations' which then provided funding for alternative economic development plans. Fifteen communities established these organisations, a total of \$294.6m was spent and 50,934 jobs were created.

Box 1: The Diablo Canyon nuclear power plant in California: a good example of a Just Transition process

This power plant was a target of environmental groups, concerned about safety due to high seismic activity in the area. In 2016, an agreement was reached between environmentalists, unions representing the workers, the company and state government. This agreement enabled the plant to remain open for eight years, so that jobs were not lost in a short notice period. Meanwhile the company invested in a portfolio of renewable energy, energy storage and energy efficiency, compensated the community for its loss of property tax revenue with US\$85m, reserved a budget of up to \$62.5m for plant decommissioning, and provided retraining and redeployment provisions for workers. The key element of success for this transition agreement was effective dialogue between the different stakeholders, including a proactive and strong union and a large, well-funded employer who provided a generous package to employees, including a 25% annual bonus followed by a severance allowance. It is

⁴⁴ Labor Network for Sustainability and Strategic Practice: Grassroots Policy Project, 2016, *op. cit.* p.2.

⁴⁵ Community Assistance, Energy Gov. website, [link](#).

too early to tell if the agreement has the desired effect on enabling a positive transition, but the process of reaching a generous agreement is in itself an achievement.⁴⁶

In his last year in office, President Obama created a 'Power + Plan' Fund to support workers and communities affected by the transition to clean energy, in particular for the declining coal industry (Box 3). Although it is too soon to judge the impact of this programme (only 2 years in), it is a significant example of the principle of a national government programme, with regional development cooperation, to facilitate a Just Transition for former high-carbon industry workers and their communities.

Box 2: The Power + Plan in the USA: 'forging new economies'

This was a transition plan devised with unions and other key stakeholders with these key elements:

- The 'Power' plan – \$55m in 2016 and \$66m in 2017 from a number of different federal agencies for job training, job creation, economic diversification and other community programmes affected by the declining coal industry. This included \$20m for the Department of Labor's Dislocated Workers National Reserve – grants to states that have experienced a significant dislocation event, such as mass layoff or plant closure. Funds are for job training grants to expand capacity of states and local communities to provide re-employment services, job training, subsidized employment, and supportive services to help the unemployed find work.
- \$1 billion Abandoned Mine Lands fund of five years to invest in economic diversification and development programmes and to clean up projects at hazardous abandoned mines that boost employment and business opportunities.
- Health and pension benefits provided to United Mineworkers retirees, threatened by bankruptcy in coal.

The Appalachian Regional Commission was granted \$25m for communities affected by coal transition, to support economic development planning and implementation, entrepreneurial ecosystems, access to capital and infrastructure projects.

Already there are a number of initiatives that are leading to new business creation and job creation, for example digital companies, where former coal workers are re-trained as coders. The Appalachian Regional Commission (ARC) is investing in digital infrastructure such as high-speed broadband to facilitate this digital cluster industry.

This Transition Fund creates grants for communities, entrepreneurs and businesses to utilize in the way best suited to their interests, skills and local opportunities, rather than a top-down process of identifying the most appropriate sectors for government to invest in.

⁴⁶ ITUC, 2017, *op. cit.* p.2.

Box 3: The role of a regional commission

The ARC has been in place since 1965, supporting the transition of the region away from coal to alternative livelihoods and infrastructure. It has seen improvements for the region over time as follows:

- The number of high-poverty counties in Appalachia dropped from 295 in 1960 to 84 in 2017. Overall poverty rate decreased from 30% to less than 17%.
- The \$3.8 billion in ARC non-highway investments were responsible for creating nearly 312,000 jobs and \$10 billion in added earnings in the region. On average, annually, these ARC funds supported an estimated 6,364 jobs and \$204m (in 2013 dollars) in earnings.
- ARC has played a role in supporting the expansion of health care and education facilities to support the well-being of the population. These efforts helped address market failures that could have significantly diminished the health and welfare of the region's residents.

Participants in focus groups said that economic transformation in Appalachia is not so much about diversification but more about forging entirely new economies, e.g. investing in preparation of industrial sites, and support for entrepreneurship, tourism development and promotion, and export expansion.⁴⁷

This review identified the following typology of interventions:

- Financial compensation for workers
- Job retraining and skills development
- Infrastructure regeneration projects
- Regional support schemes to promote economic diversification
- Stakeholder forums for participation and dialogue

In the literature we reviewed, the most successfully managed transitions (such as Bilbao in Spain, and Lausitz and the Ruhr valley in Germany) used a range of different levers in combination, with short-term measures such as redundancy payments, alongside longer-term measures like entrepreneurial development and infrastructure projects.

We review the findings from these five interventions below.

⁴⁷ Appalachia Then and Now: Examining Changes to the Appalachian Region since 1965, Appalachian Regional Commission, 2015, [link](#).

5.1 Financial compensation for workers

For older workers nearing retirement age, an early pension is a vital and basic element of a transition agreement. However, a 'golden handshake' for former workers – a lump sum payment – is a less effective policy. This often left workers in a worse place several years later, where the money had been used as income rather than to retrain in alternative employment.

Redundancy payments that were lower or shorter but combined with retraining packages (such as retraining or relocation costs paid) fared better than those given a larger payment on redundancy.

The case study in Box 5 of Shenyang in China is an example of a government initiative to transition the area including provision of a fund to support the workers.

Box 4: The role of a regional commission provision of a fund in Shenyang, China

A number of policies have led to improvements, with the provision of a fund for workers losing jobs in heavy industry to take early retirement and/or retrain.

The 'rust belt' of northeast China saw the creation of a large new group of urban poor, having been laid off relatively well-paid and secure jobs. Following protests by iron and steel workers in Hefei after a plant was closed with 4,800 people losing their jobs, authorities and companies across China have been keen to avoid further social instability and so reduced wages and shortened shifts rather than layoffs. Alongside policy measures to foster alternative industrial development, the central government in China set aside ¥100bn (US\$15.7bn; £11.6bn) as an aid package to fund any retraining, early retirement and the creation of new public sector jobs between 2016-2018.

This fund total has not been sufficient, mainly due to the early retirement age paying state pensions from age 55 to women and from age 60 to men.

In 2013, the national pension system had a surplus of ¥60bn. By 2015, this was a deficit of ¥180bn. If national retirement and employment is conducted without changes, China will be liable to pay retired workers a total of ¥773tn (\$122tn; £89tn) by 2050. However, the ¥100bn fund was supposed to go primarily to help the 1.8m workers in coal and steel expected to lose their jobs from 2016 until the end of 2018. That equates to a maximum ¥55,000 (US\$8,677; £6,382) per worker (without administration costs) to fund job replacement and training services, early retirement for older workers, and any subsidized new public sector jobs.⁴⁸

One of the challenges with the retraining package was the attractiveness of the early retirement option, so most eligible workers chose to leave the workforce. Another challenge

⁴⁸ Exchange rates: XE.com, accessed 14.05.18, [link](#).

was the laid-off heavy industry workers tended to be older than 40, making retraining harder because manual labour in the heavy industry is all they have known for so long.⁴⁹

Most importantly, Transition Funds cannot simply be used to prop up the status quo and shift the burden of fiscal responsibility from the companies to the state.

Transition Funds need to be used to ease the blow in the short term for workers, ensuring they and their families don't fall into poverty and ill health, but must be designed towards retraining and redeployment, and diversifying for alternative livelihoods.

Meanwhile in the UK in 2018, an unprecedented joint enquiry by four parliamentary committees into air pollution recommended that the government 'needs to require the automotive industry to contribute to a new clean air fund, following the 'polluter pays' principle, on a scale that adequately compensates for the costs of diesel pollution.' This is an example of how Transition Funds can be set up and paid for by the industries responsible for the costs of pollution.

5.2 Job retraining and skills development

On-the-job learning

The Dutch government, in a rare example of well-managed coal transition, focused on retraining workers with 'on-the-job learning' rather than classroom-based training. This was found to be an effective policy along with government investment in alternative sectors, and by moving government and universities to the region.⁵⁰

Creating a special purpose vehicle to create jobs

In 1991 in Lausitz, Germany, a rapid energy transition took place as a result of the reunification of West and East Germany at the end of communist rule – with decentralisation of energy provision and policies to increase renewable energy production, causing the lignite mining in former East Germany to collapse. With potentially high levels of unemployment in mainly rural areas with limited alternative jobs, a number of initial measures were put in place by the new government. Early retirement was offered to coal workers aged 55 and above, and shorter working hours introduced to ensure a gradual closing down of the mines and plants, allowing workers to start to seek alternative employment whilst still working and earning.

⁴⁹ Further information on this case study is available in Annex 1. Source material includes: Caldecott *et al.*, 2017, *op. cit.* p. 12.

What To Make Of Industrial Layoffs, Cui, Gavekal Dragonomics Ideas, 2016.

China's laid-off workers pose daunting welfare challenge - Early retirement for 1.8m in coal and steel sectors imposes heavy burden on state, Feng, Financial Times, 2017, [link](#).

⁵⁰ *Coal transition in the Netherlands*, Gales & Hölsgens, IDDRI and Climate Strategies, 2017, [link](#).

In addition, the central government created a regional management company – the Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft mbH (LMBV) tasked with making the areas of the closed lignite mines more secure, as well as cleaning up the environmental damage caused by the industry. Shortly after it's creation, the LMBV created twenty-thousand new jobs, providing jobs for the redundant lignite workforce in decontamination and environmental clean-up.⁵¹ Alongside this, the redundant mines were flooded to create lake landscapes as part of an effort to promote tourism as an alternative source of jobs and economic infrastructure.

The fast introduction of these measures shortly after 1990 helped workers to ease into new roles or early retirement without a large number of people being without jobs from one day to the next. This speed led to a lack of immediate unrest in the laid-off workforce, and allowed a gentler economic transition of the Lausitz.

These transition measures were viewed as a 'package'. The package itself was well thought through and well received by the laid-off workers. However, broader challenges remained with stagnation for some workers, because while the short-term transition measures were very successful, there was not a long-term plan for continued growth in new jobs. Recent efforts, including the creation of a regional innovation hub for businesses and the technical university, are aiming to facilitate the next wave of transition by identifying potential new businesses and developing the skills required for their growth.

5.3 Infrastructure regeneration projects

The many roles of infrastructure: use existing, repurpose or purpose-build afresh.

Many of the case studies we looked at either utilised pre-existing infrastructure (e.g. a university knowledge base), repurposing (e.g. turning old mines into lakes), or depended upon investment in new infrastructure (e.g. new transport links); for example, in ensuring better transport connections for rural areas, and digital upgrades for areas investing in high technology as part of the diversification policy.

In Bilbao, investment in state of the art transport infrastructure was key to transforming the area's ability to become a successful tourism destination, but also sustain broader redevelopment. In China, international transport links have been a key element of success for the transition of heavy industrial areas to high-tech global partnership. In Lausitz, a lack of investment in infrastructure was one of the key factors in the slow success of long-term transition. The Shengyang case study illustrates the enabling role that infrastructure can play to support transition, as described in Box 6.

⁵¹ E3G, *op. cit.* p.11.

Box 5: The enabling role of infrastructure in Shenyang 2015

The German-Chinese Industrial Park in Tiexi District was approved as a national pilot project by the Chinese State Council in 2015. Over 50 German companies have since settled in Tiexi District, including BMW, Festo, Siemens and BASF. A direct train line connects Tiexi District with the German city of Duisburg in the Ruhr Valley, with a regular train running each week. BMW uses the connection to ship automotive parts from Germany to Shenyang. The Shenyang municipal government sees this example of infrastructure as advantageous for Tiexi District:

“The 48 km² (12 km x 4 km) area with ideal infrastructure is an internationally competitive location for high-end technologies.”

To strengthen the all-important connection to the capital, Shenyang will also be connected to Beijing through a high-speed rail line, due to be completed in 2019. Future development plans include a total land area of 30 km² planned for the development of a China-France Eco-City. This project aims to build up a local industry for green technologies in equipment manufacturing.⁵²

The significant funding provided by local government in Shenyang has been instrumental in enabling tax breaks to allow high-tech industry to locate there.⁵³

5.4 Regional support schemes to promote economic diversification

It is not enough simply to support workers who lose their jobs during a transition. The broader community, often providing services and ancillary businesses, also needs support. This is vital to prevent long-term inequality and area decline.

Critical success factors

The Ruhr Valley in Germany is often identified as one of the most successful examples of regional economic transition away from a dependence on coal and steel to a more diverse economy with high levels of growth.

This example made use of sector cluster policy. This approach aims to identify regions with high growth potential and provide support to develop specific sectors.⁵⁴ The presence of a research institute and qualified workers, along with stakeholder dialogue to ensure legitimacy for the cluster vision, will support the cluster's success. Coordination and cooperation between research institutes and businesses and enterprises is a critical success factor in developing a knowledge-based economy.

⁵² *Shenyang City Profile – Research Report*, Jones Lang LaSalle, 2016, [link](#).

⁵³ *Shenyang: A Home for German Companies*, Shenyang Municipal Bureau of News, PR Newswire, 2016, [link](#).

⁵⁴ E3G, 2016, *op. cit.* p. 17.

Providing infrastructure and advice for start-ups is also a key element of success in encouraging cluster development, particularly for start-ups and small and medium enterprises (SMEs) – see section 5.5 on infrastructure support. For rural areas, funding infrastructure and loans for local businesses will be essential. A good quality of life with transport, education, childcare and leisure infrastructure is essential to retain qualified personnel in an area or enable commuting, and therefore the success of growing knowledge-based economic diversification.⁵⁵ Measures need to be put in place to manage the loss of tax to municipal budgets, and the subsequent knock-on effects on infrastructure maintenance.

The presence or introduction of higher education centres into a region undergoing transition has been shown to be an effective strategy for fostering innovation, entrepreneurship and training for future employees.

A number of programmes and measures in the Tees Valley in NE England have delivered a successful transition by focusing on the role of higher education.

The area suffered high unemployment following the loss of over 93,000 manufacturing jobs with the decline of a few large employers in the steel and chemicals industry operating since the 1970s. The area transitioned from heavy manufacturing to an economy based on information and communication technology (ICT), creative media and advanced manufacturing as a result of regional interventions to foster innovation during the 2000s.⁵⁶

Residents in the area suffered from ‘low expectations and poor education and skills acquisition’ and despite the presence of five universities in the region (Newcastle, Northumbria, Durham, Teesside, Sunderland), lacked links between these knowledge networks and innovation, start-ups and innovation enterprise. A programme established by a regional development agency, ONE North East, invested over £3m for the five universities to build enterprise capacity, building on previous initiatives by other foundations, by:

- Providing support for students and university teams to develop business skills
- Supporting micro businesses directly, for example with premises and access to network of specialists, and raising awareness of entrepreneurship
- Developing links between universities and industry
- Encouraging and supporting graduates to remain in the region

The types of support created included for example:

⁵⁵ E3G, 2016, *op. cit.* p. 17.

⁵⁶ Tees Valley Economic Assessment, 2013, Tees Valley Unlimited.

- Establishing incubation facilities with premises and specialist support for graduate start-ups, and targeted investment in areas of university expertise with potential for high growth business creation.
- Development of a Centre for Entrepreneurial Learning at Durham University, and an enterprise development programme at Teesside for students, graduates and staff.

As a consequence, these initiatives generated new jobs, businesses and skills and leveraged additional funding. The unemployment levels decreased from c.13% in 1993 to less than 6% in 2017, and poverty rates have declined (although remain higher than the rest of the UK).⁵⁷ The changes in these unemployment and poverty rates cannot be directly attributed to the programmes' efforts, but illustrate the general picture of improvement through a number of initiatives. Although the regional body has now been closed, the enterprise initiatives continue; for example, the new 'DigitalCity' initiative, seeking funding from alternative sources of grants.

Alongside the university-entrepreneurial initiatives, ONE North East also identified renewable energy and low-carbon emission vehicles as having potential for growth in the region. Given the region's existing infrastructure for heavy industry – with port facilities and engineering skills – a National Renewable Energy Centre was established in 2002 to develop offshore wind turbine manufacture. The Centre provides testing, research and operation innovation, and has become a global hub for business creation, academic collaboration, industry collaboration and SME support. Examples include:

- Indian company Corus developing a £31.5m offshore wind farm business in Tees Valley, creating 220 new jobs.
- Brazilian firm VSE acquiring Gateshead-based Turbo Power Systems for £10m, creating 145 new jobs and safeguarding 75 existing jobs.

A programme fund was also created to identify and grow opportunities in low-carbon manufacturing, to redevelop land, create new businesses and create new jobs, and lever in additional private business investment. One of the outcomes was the support given to 1,200 workers affected by Nissan's decision to reduce its Sunderland workforce in 2009. The agency worked with Nissan to develop ultra low-carbon vehicles to ensure jobs were protected and created, by creating academic partnerships, vehicle pilot funds and funding for electric charging points. As a result, the first affordable, mass-produced zero emission car, the 'LEAF' was created in 2013, and a European Centre for Excellence for Battery Manufacturing has been established in Sunderland. Some 220 jobs were protected at Nissan (and across the UK).

This case study shows the potential for redeveloping a whole region with investment in higher education and entrepreneurial and innovation hubs.

⁵⁷ LFS: ILO unemployment rate: North East: All: %: SA, Office for National Statistics, [link](#).

Regional regeneration can create whole new cultural identities, a source of pride for communities.

In Bilbao, new developments as part of the city's regeneration were commissioned by leading architects to help ensure a new image that was vibrant and dynamic. The Guggenheim Museum, for example, was commissioned by internationally prestigious architect Frank Gehry. It was built in a part of the city that had previously been a heavily polluted industrial area with steel plants, shipyards and ports closing, and high rates of unemployment. This building has become globally iconic and has supported Bilbao in its rebranding as a successful tourism destination. Bilbao now attracts over 800,000 visitors a year, compared to 100,000 before the museum opened.⁵⁸ It should be noted that the 'Bilbao' effect, as it is referred to, tends to focus on the Museum building itself as the factor in the successful transition of an area of post-industrial decline. Although this has played a role in the transformation of the identity of the area, with a striking visual symbol, the successful transition was due to a wider strategy of change, involving transport infrastructure investment (metro trains), urban space redesign and adding new green public space. In addition, although the museum is now cited by residents as a source of pride, when it was first proposed it was met with opposition and a lack of participation.

In Scotland, the transition of some areas such as the Orkney Islands, from oil dependent communities and economies to renewable energy, has led to a revitalization of the area that has now positioned itself as a lead in wave and tidal energy technology, with the establishment of a university campus and a supply chain of local businesses and research organisations.

Box 6: Shenyang, China: a region-specific plan, utilising existing redundant heavy industry infrastructure to create a high-tech manufacturing area

A ¥50m (US\$7.8m; £5.8m) local government fund established in 2015 supported the establishment of private high-tech industries. The fund enables the local government to allow tax breaks to companies in the range of 15-25%. In addition, companies that qualify for high-tech status also receive a ¥200,000 (c.US\$31,550; £23,270) bonus.⁵⁹

The municipal government established Shenyang Economic Development Area in the Tiexi District and is diversifying investment, both from sectors and countries. For example, BMW from Germany and Michelin from the US are located in different areas of the city, with a different set of infrastructure offered.

⁵⁸ *The New Social Contract: A Just Transition*, Change Partnership & The Foundation for European Progressive Studies (FEPS), 2016, [link](#).

⁵⁹ Shenyang, a City of Successful Transition from China's Industrial Pioneer to Innovative Manufacturer, Shenyang Municipal Bureau of News, 2016, [link](#).

Box 7: Hazlewood Power Station and Latrobe Valley, Australia: a region-specific plan, but timing issues, 2016

Hazlewood Power Station is Australia's most polluting coal-fuelled thermal power station. Subsidies, tax concessions and region-specific action plans were implemented by state and federal governments as part of the transition plan for this region. An AUS\$266m (US\$200m; £148m)⁶⁰ package of support for the region was announced including the following:

- A Worker Transition Centre established in partnership with the local Trades and Labour Council – a one-stop-shop for individual support.
- Education, counselling, financial advice and subsidised job-seeker training for workers in transition.
- Tailored support for businesses to help them identify new opportunities and develop a transition plan.
- An expansion of the Back to Work program to businesses that employ workers in the Latrobe Valley.

The funding, a call centre and website went live on the day of the announcement of the closure, providing affected workers with access to information and support. This meant the infrastructure upgrades/developments were not in place or even underway when the power station and mine closed.

At the same time \$20m (£14.7m) was announced to fund the establishment of a dedicated Latrobe Valley Authority to lead the government's response and manage the transition and future economic development of the Latrobe Valley. The new authority is now working with locals and businesses, the local Regional Partnership and all levels of government to cut red tape and include local voices.

The majority of funding was allocated to a community infrastructure and investment fund, which will target projects for essential infrastructure development or upgrade e.g. roads, rail, sports and recreation facilities. Although this example also used the creation of a dedicated authority to enable the transition, unlike the earlier German example the timing of this was at the announcement of the closure, rather than preparing for it.⁶¹

5.5 Stakeholder/Civic Forums for participation and dialogue

Stakeholder dialogue has repeatedly been shown to be a key ingredient in successful transitions.

⁶⁰ Exchange rates: XE.com, accessed 14.05.18, [link](#).

⁶¹ ITUC, 2017, *op. cit.* p.12.

Stakeholder dialogue can be valuable in establishing priorities, enabling buy-in for implementation, exposing any vested interest and establishing trust. Dialogue can be initiated by communities or workers themselves in a bottom-up process, or part of a more top-down process of setting the political framework and policy support. Dialogue can take place with public consultations, roundtable discussions or community meetings. A forum for stakeholder dialogue that allows workers and communities to air their concerns, discuss and input into plans and ideas can ensure a more stable, well-managed transition. Stakeholder dialogue enables honesty about accepting a declining industry, before it is in crisis management mode, so that the workers and their communities have time to adjust to the changes rather than denial and continued promises that the workers will be protected in the status quo.

Stakeholder dialogue can create agreement on a long-term plan, and so reduce risk of social unrest, public backlash or lack of investment.

Dialogue can also be a process of identifying alternative enterprise and innovation based on local insights. It is a vital way to bring together workers, industry and local government to create a shared vision and promote transparency, which can be the best tool for exposing bias and attempts to evade responsibility.

*“Participatory structural policy is nowadays considered best practice as it tends to improve both the effectiveness and local buy-in of programmes”.*⁶²

Box 8: A Citizens Advisory Committee, established to steer the retirement of a coal mine, Bridgeport, Connecticut, US

The Healthy Connecticut Alliance (an alliance of environmental and community organisations) campaigning against a coal mine, included a series of measures for workers such as alternative jobs for workers, job retraining, pensions and healthcare, land restoration jobs and reutilizing facilities. This campaign group of local residents were concerned about the negative health impacts of the coal plants located so close to housing.

The decision to close the coal plant was eventually taken in 2014 with a retirement date set for 2021. This led to the City Council establishing a citizen advisory committee to explore alternative uses of the site, post-retirement of the coal mine and to ensure the local community had a say in the future.⁶³

In Bilbao, the City Council launched public discussions around how best to reshape the city right at the start of the regeneration process but some 90% of the local population initially opposed the building of the Guggenheim Museum, citing concerns relating to cost.⁶⁴ It is now, however, a source of local pride and a key part of the city’s new identity. In this instance,

⁶² E3G, 2016, *op. cit.* p. 17.

⁶³ PR Newswire, 2016, *op. cit.* p. 24.

⁶⁴ FEPS, 2016, *op. cit.* p.27.

strong leadership with a clear and consistent vision was key to delivering the transition and eventually winning around the local community. The appointment of a trusted management company also contributed to the success, supporting liaison and dialogue between different stakeholders, whilst also being responsible for delivering the political vision for transition. The management company won the trust and respect of the local population and this seemed to be a key factor in preventing dissatisfaction with the process.

Stakeholder dialogue can contribute to establishing and shaping a political and social narrative, which supports the success of the transition and builds further support for it.

Box 9: Transition towns

A community-led initiative that began in a town in England in 2006 has now spread to other countries to become a global network. The concept of 'transition towns' is that people within a community come together to plan and implement the transition to a low carbon, sustainable town/city/village. An umbrella organisation, Transition Network, was established to share lessons and tools.

The 'transition town' initiative is based on principles, for example reducing reliance on fossil fuels and promoting inclusivity and social justice, but without specific carbon targets. It is designed to be a toolkit for grassroots social change, and has led to the creation of community energy companies and food co-ops. Given the diversity of initiative,s it is not possible to measure the impact on reducing carbon emissions.

Community energy

Community-owned energy has been a feature of renewable energy generation from the beginning. Traditionally this took the form of community-owned forms of energy generation, through co-operative models of ownership, from a wind farm to a solar panel on a school.

Denmark's wind industry began in the 1970s with a strong community energy driver, as farmers and local residents came together to build and own wind turbines. This grew into models of wind farm ownership. Denmark's leading position now as a wind turbine manufacturer is partly due to the role that community energy played in providing a guaranteed market for testing and developing wind turbines. In Germany, the fourth largest economy in the world, 47% of installed capacity is owned by citizens and communities.

Community energy can range from a community share in a private large-scale renewable energy project, such as a wind farm, to a community developing and financing and then owning the whole development, a community interest model of energy company.

The sector has now grown from small-scale solar rooftop to much more ambitious projects. It represents an example of how the transition from high to low-carbon industry, in the energy sector, can be facilitated by co-operative ownership models of engagement. Community energy has shown to be a key factor in facilitating the transition by:

- Creating local support for large-scale developments.

- Becoming a way for communities to participate in the energy transition and benefit financially.
- Using the profits from community energy projects on developing further low-carbon infrastructure – for example an electric charging point installed in the local town and a hydro energy project being developed in Victoria, Australia.

A summary of the elements of the typology against the five main case studies is shown in Table 2.

Table 2: Elements of the typology against the five case studies

Elements of typology / case studies & examples	Financial compensation for workers	Job retraining and skills development	Infrastructure regeneration	Regional support	Stakeholder/ civic forums
Lausitz, Germany	Y	Y	Y	Y	N ⁶⁵
North East England	N	Y	N	Y	N
Shenyang, China	Y	Y	Y	Y	N
Bilbao, Spain	Y	Y	Y	Y	N
Scotland	Y	Y	Y	Y	Y
Diablo, CA, USA	Y	Y	N	N	Y
Power Plus Plan, USA	Y	Y	Y	Y	Y
Appalachia, USA	N	Y	Y	Y	Y
Latrobe Australia	Y	Y	Y	Y	Y

⁶⁵ This has been highlighted as a key gap that may threaten the long-term sustainability of what was a very successful short-term transition.

6. Conclusions

This report explored how transitions can be better planned for, managed and delivered. The examples identified show the possibility not just of mitigating the worst impacts on workers and communities, but the economic and social opportunities that a well-managed transition brings to regions and economies.

The report has developed a typology of the interventions that can be combined to enable a successful transition. These can be applied across any sector or country. The key is in combining the elements in the right time and with enough support. This support is more than simply a one-off financial transaction in the form of redundancy payments, but is structured long-term support for the workers and the community in that region. There are examples of how this has been successfully applied in relatively short time periods (5-10 years) but all transitions are ultimately a long-term evolving plan.

It is not enough simply to support workers who lose their jobs during a transition. The broader community, often providing services and ancillary businesses, also needs support, for example with cluster policies to support a particular sector or region. This is vital to prevent long-term inequality and area decline.

Some sectors will potentially see an overall net increase in job creation, for example in automation and energy generation, however this cannot mask where there is inevitable job losses. Some workers will not be able to easily move jobs, or relocate or reskill, and so plans need to be in place for due warning, preparation and financial support.

Where redundancy payments were combined with retraining packages, these were more effective than higher total redundancy pay.

Where governments plan in advance for the low-carbon transition, ensuring education and training are suited to future and evolving low-carbon economies, and regions are supported in diversifying their economies, the negative social and economic impacts are avoided and the economy is being positioned to capitalize on the low-carbon transition. Managing low-carbon transitions needs to be contextualized to include the wider transition agenda for the future of work, including the broader technological trends, for example in automation and manufacturing.

Stakeholder dialogue is a critical factor in the success of a transition to ensure buy-in and transparency, preventing backlash and generating support for the process, not just by the workers who face redundancy but for the broader community also impacted – the ecosystems of supporting businesses that grow up around an industry, for example as well as the social

fabric from schools, clinics, community centres and hospitals that face changing income. There are numerous examples of workers in highly polluting, industries mobilizing to call for support in transitioning to low-carbon livelihoods.

Transition Funds can be used to ease the blow in the short term to prevent workers and their families falling into poverty or ill health, but must be designed towards retraining, redeployment and alternative livelihood diversification to be most effective. Transition Funds cannot be used to prop up the status quo, delay climate action, or shift the fiscal responsibility from companies to the state. They need to be designed to enable improved capacity for workers and communities to make the transition on their own terms.

Transition to a low-carbon economy has the potential to be more than just less polluting. Packages of revitalization and diversification can be dynamic, inclusive, healthy and with better work opportunities, thus providing a source of regional prosperity and pride. The necessity of implementing climate policy can be designed to deliver a source of community regeneration and renewal rather than just preventing loss. Well-managed transitions can result in a revitalization of a region, with enhanced prosperity and well-being by moving away from 'economic lock-in' from high carbon industry.

7. Recommendations for grant makers

Recommendation 1:

Grant makers should develop a strategy that incorporates a set of principles and practical applications for managing transition within both sector and country climate change programmes. These can be achieved by enabling policies and tools put in place by partner governments or facilitated by grantees. This could include a suggestion to all relevant grantees to consider designing in transition strategies. For example:

- development of screening protocols to identify ways to design out potential negative social impacts of climate policies;
- identification and articulation of the co-benefits to be derived;
- establishment of budget lines for advocating transition policy measures.

Grant makers could also consider publication publishing of a range of advocacy products to support government policy design.

Recommendation 2:

Stakeholder dialogue has been shown to be a critical tool to create and enlarge the space for facilitating the transition – creating public support for increasing climate ambition, preventing backlash and enabling co-design of climate policy. This includes more formal processes of social dialogue between workers and their unions; employers; and governments, which has proven to be key in negotiating the work, economic and social aspects of transition, and securing the support of the world of work.

Governments are not always best placed to pay directly for or facilitate stakeholder participation and dialogue, but they are dependent on this to be in place in order to accelerate the low carbon transition. In social dialogue, by contrast, governments can play a key role in convening the parties.

Stakeholder dialogues can be created and facilitated by unions, civil society organisations or independent facilitators, who can enable an honest dialogue about the work and community impacts of transition, and help plan for the future. Social dialogue is convened and carried out by unions, employers, and governments, who may also decide to include other actors in the process.

Almost all of these require grants, and so this is a critical role for grant makers.

Stakeholder dialogue potentially enables faster, more successful low-carbon transition and so is an essential element of the grant makers' toolbox to manage change and deliver climate goals.

Recommendation 3:

Given the relative paucity of information on how to ensure successful transition relevant to middle-income countries, grant makers could commission primary research to identify policy case studies that are relevant to the transition in key middle-income countries, for example in China, India, Indonesia and South Africa.

Delivering more primary research, particularly focusing in on the wider social impacts and interviewing the workers themselves rather than relying on general job figures, will further support the case for a transition to a low-carbon economy.

Recommendation 4:

Having identified a typology of successful interventions, grant makers could commission further research to test this and to identify whether there are particularly important sequencing issues or optimal levels and types of intervention.

8. Recommendations for policymakers

Recommendation 1:

Policy makers need to factor in transition measures alongside climate policies since the government policy response can significantly affect the outcome of transition. A proactive fiscal or policy approach to sectors and regions that will be most affected by the low-carbon transition will enable them to become more productive and prosperous, contributing to economic and social development. Specific transition measures can complement the national policy approaches. These measures may include regional funding and policy to support economic diversification, targeted infrastructure investment, training and education, social protection, and ensuring adequate pension and redundancy provision.

Recommendation 2:

Policy makers should find ways to support the participation and dialogue process given that communities and their representative organisations (such as unions, faith and community groups) have a critical role in discussing, co-creating and then implementing the transition vision. With communities and workers engaged in the transition, the whole process can be accelerated. Without this support there is potential for backlash that can slow down or disrupt the transition process.

Specific government established Transition Funds can also provide grants to create the capacity and resource for communities, businesses and workers to proactively accelerate the move away from fossil fuel-based jobs and industries, rather than to just adjust to decline.

Recommendation 3:

Government intervention may be required to ensure that businesses make a contribution to the costs of transition proportionate to their impacts. Heavy polluting industries have a responsibility to pay for the costs required for the transition to low-carbon economies, and often do either voluntarily and directly, or involuntarily or indirectly. However, some companies may opt to go bankrupt, or foreclose, without fulfilling their financial or environmental obligations to the workers or local community. Companies can be required by governments to make payments into specific Transition Funds, for example, or payments for specific measures such as land restoration and clean-up, and/or towards pensions and redundancy for workers.

Annex 1: Case studies

Case study	Time period	Scale of transition	Sector in transition	Transition measures taken	Key lessons learned
Lausitz, Germany	1990 – 2000	90% of jobs lost within 10 years: from 80,000 in 1990 down to 20,000 in 1995, and down to 7,000 in 2000.	Coal mining, heat and power from coal, associated industries	Creation of a new decontamination organisation in 1991 that supplied 20,000 short-term jobs; early retirement; reskilling; establishing a new key industry.	<p>Political regime change can force a transition in extremely fast timescales.</p> <p>Longer-term alternatives to coal industry employment are highly dependent on general infrastructure and the degree of urbanisation in the affected region.</p> <p>It is important to pursue short- and long-term transition measures at the same time to ensure regional stability beyond the short-term effects.</p> <p>The local population has to be engaged in the transition process; without this stakeholder engagement, appetite for new transition measures is low.</p> <p>The dependency on tourism may make the successful transition precarious.</p>
North East England, UK	1971 – mid 2004	Over 93,000 manufacturing jobs were lost from the area, principally due to rationalisation of	Heavy manufacturing incl. steel, chemicals and engineering	<p>Transition measures for education investment were taken after the transition had taken place. These included:</p> <ul style="list-style-type: none"> • The development of hubs for new businesses to 	<p>The funding provided by ONE North-East resulted in leverage of £2.9m in extra funds across the five supported universities. The additional funds helped to lever additional resources.</p> <p>The provision of funds has also helped with university infrastructure and the establishment of partnerships external to each university.</p>

Case study	Time period	Scale of transition	Sector in transition	Transition measures taken	Key lessons learned
		the steel industry in the UK. ⁶⁶		<p>develop and access support.</p> <ul style="list-style-type: none"> ● Raising awareness of entrepreneurship and capacity building. ● Building networks and centralising innovation and entrepreneurship within dedicated university centres/ departments. 	<p>The enterprise agenda has also been taken up by the universities involved in the programme, ensuring that this forms part of their mission and core strategy.</p> <p>Lack of funding both for core and non-core activities can curtail progress, thus the sustainability for some of the activities is threatened by the need to rely on grant-based funding.</p> <p>The universities each took different approaches to delivering the enterprise programme with varying results. This mirrors findings in other literature that state regional and cultural norms impact how successful programmes relating to enterprise can be.</p> <p>Planning an exact outcome in relation to the development of an enterprise programme is not straightforward and will be influenced by a number of cultural human factors that cannot be controlled.</p> <p>The establishment of partnerships and networks external to the universities helped engage local support.</p>
<p>Shenyang (沈阳) NE China, Liaoning Province, the capital</p>	<p>2 distinct periods: 1. c. 1998 – 2003 2. 2015 – present</p>	<p>Nationally, 700,000 of 2.8m workers in state-owned coal mining companies laid off late 1990s to early 2000s⁶⁷ –</p>	<p>Coal mining, heat and power from coal, steel</p>	<p>The central government policy of ‘Made in China 2025’ prompted the local government to set up a ¥50m (US\$7.8m; £5.8m) fund in 2015, to establish a private high-tech industry.</p>	<p>Launch of the central government policy of ‘Made in China 2025’ kick-started Shenyang Economic Development Area (SEDA), located in the previous heavy industry Tiexi District.</p> <p>Repurposing a redundant industrial area as a high-tech manufacturing area has provided a new source of economic development and employment opportunities.</p>

⁶⁶ Tees Valley Economic Assessment, 2013, Tees Valley Unlimited.

⁶⁷ Page 28 in Caldecott *et al.*, 2017, *op. cit.* p.12

Case study	Time period	Scale of transition	Sector in transition	Transition measures taken	Key lessons learned
Shenyang		(no reliable statistics available through reviewed materials for Liaoning Province/ Shenyang since 1990s).		National measures to enable the transition away from heavy industry include an early retirement and retraining fund worth ¥100bn (US\$15.7bn; £11.6bn).	The significant funding provided by local government has been instrumental in enabling tax breaks to allow high-tech industry to locate there. Central and local government support can be complementary and mutually reinforcing.
Bilbao, Spain	1983 – mid 2000s	60,000 manufacturing jobs lost between 1975 and 1995; this saw the proportion of manufacturing jobs drop from 46% to 27%.	Heavy manufacturing incl. steel, shipbuilding and machine engineering.	The Spanish government developed a 'Strategic Plan' to revitalise metropolitan Bilbao, which included their agreement to pay for the costs of relocating industry out of the metropolitan area, a shift towards a knowledge-based, high-tech sector and an early retirement plan for industrial workers aged over 50.	The need for negotiations relating to the closure of capacity or retirement schemes with workers to be led by the national government in accordance with EU law. <i>"Once local governments take ownership of the need to transition, they have been able to dramatically redesign local socio-economic models in a timespan of about 20 years."</i> ⁶⁸ In the Bilbao case, a key to this success was bringing together all levels of government in the project, creating a carefully constructed but functioning balance between different political interests. ^{69,70} The transition of the area created a source of new pride and identity. The iconic Guggenheim museum played a role, but the investment in infrastructure was just as important.

⁶⁸ FEPS, 2016, *op. cit.* p.27.

⁶⁹ *Bilbao Ría 2000 – Transformation of Bilbao, Spain through public/private partnerships*, Sustainable Development Knowledge Platform, United Nations (undated), [link](#).

⁷⁰ Efforts to rebuild Bilbao with a focus on developing a knowledge-based, high-tech sector ultimately resulted in a rise in service sector employment. This rose from 42% in 1974 to 65% in 1995. Overall unemployment rates also dropped from 25% in the 1980s to 20% in 1997, and to 11% by 2004. The overall number of jobs in the metropolitan area grew from 267,000 in 1995 to 380,000 in 2005. Employment in hospitality and tourist-related services rose steeply as tourist arrivals increased, partly linked to the business tourism promoted by the Euskalduna Conference and Events Centre and to the new Guggenheim Museum.

Case study	Time period	Scale of transition	Sector in transition	Transition measures taken	Key lessons learned
					As with Lausitz case study, the dependency on tourism for Bilbao may make the successful transition precarious. The jobs created by the service industry tend to be low paid and unskilled and subject to tourism trends. Inequality and poverty have increased in recent years. This points to the difficulty of unpicking the successful impact of 'transition policies' from other broader trends and impacts (global economic shifts and tourism tastes and trends).
Scotland	2015 – present	161,000 (34%) jobs lost between 2014 and 2017 in oil and gas industry, including 13,000 (31%) of directly employed installation staff in the UK (44% of the UK oil and gas industry jobs are based in Scotland)	From oil and gas (mostly offshore) to wave and tidal energy	<p>A specific fund, informed by a wider strategy; £12m Transition Training Fund set up by the Scottish government and managed by Skills Development Scotland offering support with grants to retrain and upskill.</p> <p>This is informed by wider country-level strategy and targets. This programme for Scotland is for 'a future-proofed, high-tech, low-carbon economy.'⁷¹</p> <p>Includes an energy strategy target of 50% RE by 2030 and climate change plan targets</p>	<p>It is important to pursue long- and short-term transition measures at the same time. The Orkney Island Archipelago shows that skills development, together with longer-term plans in renewable energy development, resulted in one of the lowest unemployment levels in Scotland and reversed the decrease in population.</p> <p>Training and reskilling are crucial in successful transition: the Transition Training Fund has approved 3,184 applications to date and the rate of success in finding new job after retraining is 85%.</p> <p>Support from European funding enabled Scotland to move towards a low-carbon economy and create a considerable number of new jobs in the renewable sector. The case study from the Orkney Islands shows that with development of the EMEC, 300 new jobs were created and the Islands become leaders in marine and tidal energy technology development.</p>

⁷¹ A Nation with Ambition: The government's programme for Scotland 2017-18, [link](#).

Case study	Time period	Scale of transition	Sector in transition	Transition measures taken	Key lessons learned
				<p>across all sectors to 2032.</p> <p>Support from the EU.</p> <p>Community Energy Scotland. e.g. Orkney is now powered by 100% renewable energy and has excess grid capacity.</p> <p>Now developing hydrogen from the excess wind and tidal energy that cannot be absorbed by the grid; selling electricity excess from Orkney.</p>	<p>Investment in renewable energy and its associated R&D has attracted people to live, work and study on the Orkney Islands.</p> <p>Strong Civic Society: pushed for Just Transition in Scotland.</p> <p>Scottish government has announced creation of a Just Transition Commission to advise Scottish Ministers on the move towards fair low-carbon economy.⁷²</p>

⁷² *Climate Change*, Scottish Government, 2017, [link](#). [accessed 17.05.2018]

Bibliography

Case studies: by country

Bangladesh

Managing the Transition to a Low-Carbon Economy Perspectives, Policies, and Practices from Asia Editors, Photovoltaic Technology, Asian Development Bank Institute, 2015, [link](#).
[Bangladesh, Chittagong hill tract]

Cambodia

Managing the Transition to a Low-Carbon Economy Perspectives, Policies, and Practices from Asia Editors, Biogas, Asian Development Bank Institute, 2015, [link](#).

Canada

Green and Local Food Jobs in the City of Vancouver, Vancouver Economic Commission, 2014, [link](#). [Canada, City of Vancouver]

Jobs and the Low-Carbon Energy Transition: Perspectives from Cumberland County, IISD, 2017, [link](#). [Canada, Cumberland County]

China

China's Long Road to the High-Efficiency, Clean and Low-Carbon Energy Transition, Peng, in Energy Engineering, pp. 51-57, Springer, 2017, [link](#).

Managing the political economy frictions of closing coal in China, Caldecott et al., Smith School of Enterprise and the Environment, University of Oxford, 2017, [link](#).

Managing the Transition to a Low-Carbon Economy Perspectives, Policies, and Practices from Asia Editors, Coal-based super critical and ultra super critical power plants, Asian Development Bank Institute, 2015, [link](#). [China, Ningbo City, Zhejiang Province]

Shenyang, a City of Successful Transition from China's Industrial Pioneer to Innovative Manufacturer, Shenyang Municipal Bureau of News, 2016, [link](#).

Shenyang: A Home for German Companies, Shenyang Municipal Bureau of News, PR Newswire, 2016, [link](#).

Shenyang City Profile – Research Report, Jones Lang LaSalle, 2016, [link](#).

What To Make Of Industrial Layoffs. Cui, Gavekal Dragonomics Ideas, 2016.

Czech Republic

Coal Transition in the Czech Republic, Reckova, Recka & Scasny, IDDRI and Climate Strategies, 2017, [link](#).

Czech Republic - Coal Sector Challenges and Opportunities, Australian Government and Australia Unlimited, 2014, [link](#).

Energy policies of IEA Countries: The Czech Republic, International Energy Agency (IEA), 2010, [link](#).

Good Practice Guidelines: Boosting the regeneration process of Europe's coalfield regions, RECORE, undated, [link](#).

Regional decline and restructuring in Ostrava agglomeration and Katowice conurbation, Suchacek, 2005, [link](#).

Eastern Europe

Comparative Study of Iron and Steel Industry Transition in the Countries of Central-East Europe and Former Soviet Union, Shatokha, European Journal of Sustainable Development, 6(4), pp.155-168, 2017, [link](#).

France

Effects of restructuring at regional level and approaches to dealing with the consequences, Eurofund, 2014, [link](#). [France, Saint-Omer, Nord-Pas-de-Calais]

Good Practice Guidelines: Boosting the regeneration process of Europe's coalfield regions, RECORE, undated, [link](#).

Jobs after coal: A Just Transition for New Zealand communities, Baxter, Campbell, Eyre, Fitzsimons, Gillies, Downing, Jones, and Penwarden, Coal Action Network Aotearoa, 2015, [link](#). [France, Nord-Pas De Calais]

Germany

A Just Transition for all: can the past inform the future? International Labour Organization (ILO), Geneva; International Journal of Labour Research, Volume 6, Issue 2, 2014, [link](#).

Arbeitsplätze in der ostdeutschen Braunkohle: Strukturwandel im Interesse der Beschäftigten frühzeitig einleiten. Franke, Hackforth and Haywood, DIW Berlin — Deutsches Institut für Wirtschaftsforschung, 2017, [link](#).

Effects of restructuring at regional level and approaches to dealing with the consequences, Eurofund, 2014, [link](#). [Germany, Hamburg]

Germany: Inclusive Renewable Energy Policy Reforms in an Industrial Economy: Appendix G, in Pro-poor, Inclusive Green Growth: Experience and a New Agenda, Global Green Growth Institute (GGGI), 2016, [link](#).

Good Practice Guidelines: Boosting the regeneration process of Europe's coalfield regions, RECORE, undated, [link](#).

Industrial Regions and Climate Policies: Towards a Just Transition? European Trade Union Confederation (ETUC), 2016, [link](#). [Germany, North Rhine-Westphalia]

Structural Change in Lusatia: What Will Come After Lignite? Schwartzkopff and Schulz, E3G, 2015, [link](#). [Germany, Lusatia Region]

The long and winding road from black to green: Decades of structural change in the Ruhr region, Galgóczi, International Journal of Labour Research 6, no.2:217, 2014, [link](#). [Germany, Ruhr Region]

The new social contract: A Just Transition, Change Partnership & The Foundation for European Progressive Studies (FEPS), 2016, [link](#). [Germany, North Rhine-Westphalia]

Hungary

Energy Policies of IEA Countries: Hungary, IEA, 2011, [link](#).

India

Electric Buses in India: Technology, Policy and Benefits, Global Green Growth Institute and Center for Study of Science, Technology and Policy, 2016, [link](#).

India's electricity-sector transformation, Buckley & Sharda, Institute for Energy Economics and Financial Analysis, 2015, [link](#).

Managing the Transition to a Low-Carbon Economy Perspectives, Policies, and Practices from Asia Editors, Hydropower, Local village electrification and Biogas, Asian Development Bank Institute, 2015, [link](#). [India, Kerala state and Tamil Nadu state]

Indonesia

Fossil Fuel Subsidy Reform in Indonesia: Appendix A, in Pro-poor, Inclusive Green Growth: Experience and a New Agenda, Global Green Growth Institute (GGGI), 2016, [link](#).

Italy

Effects of restructuring at regional level and approaches to dealing with the consequences, Eurofund, 2014, [link](#). [Italy, Prato, Tuscany]

Korea

Korea's Green Growth Experience: Process, Outcomes and Lessons Learned, Global Green Growth Institute (GGGI), 2015, [link](#).

Netherlands

Coal transition in the Netherlands, Gales & Hölsgens, IDDRI and Climate Strategies, 2017, [link](#).

New Zealand

Jobs after coal: A Just Transition for New Zealand communities, Baxter, Campbell, Eyre, Fitzsimons, Gillies, Downing, Jones, and Penwarden, Coal Action Network Aotearoa, 2015, [link](#).

Philippines

Integrated National Greening and Inclusive Forestry in a Developing Country, Appendix D, in Pro-poor, Inclusive Green Growth: Experience and a New Agenda, Global Green Growth Institute (GGGI), 2016, [link](#).

Peru

A Just Transition for all: can the past inform the future? ILO, Geneva; International Journal of Labour Research, Volume 6, Issue 2, 2014, [link](#).

Peruvian fisheries: A transition towards labour and environmental sustainability? Murillo, Maffei and Sueiro, International Journal of Labour Research 6, no. 2: 187, 2014, [link](#).

Poland

Coal Transition in Poland, Szpor, IDDRI and Climate Strategies, 2017, [link](#)

Country Case Study - Poland: Climate for Sustainable Growth, Marcu, Chruszczow, Belis, Tuokko and Stoefs, 2015, [link](#).

Energy policies of IEA Countries: Poland, IEA, 2011, [link](#).

Good Practice Guidelines: Boosting the regeneration process of Europe's coalfield regions, RECORE, undated, [link](#).

Industrial Regions and Climate Policies: Towards a Just Transition? ETUC, 2016, [link](#). [Poland, Silesia]

Regional decline and restructuring in Ostrava agglomeration and Katowice conurbation, Suchacek, 2005, [link](#).

Russia

Good Practice Guidelines: Boosting the regeneration process of Europe's coalfield regions, RECORE, undated, [link](#).

Rwanda

Rwanda: Using Ecotourism to Create Livelihoods and Protect Biodiversity: Appendix B, in Pro-poor, Inclusive Green Growth: Experience and a New Agenda, Global Green Growth Institute (GGGI), 2016, [link](#).

Slovenia

Effects of restructuring at regional level and approaches to dealing with the consequences, Eurofund, 2014, [link](#). [Slovenia, Pomurje]

South Africa

South Africa: Implementing Holistic Environmental and Social Protection Strategies in an Emerging Economy: Appendix E, in Pro-poor, Inclusive Green Growth: Experience and a New Agenda, Global Green Growth Institute (GGGI), 2016, [link](#).

Spain

Beyond Coal. Sustainable alternatives for the future of coalfield regions. Case Study: Alternative Development for Teruel Coalfield Region, Greenpeace Spain, 2016, [link](#). [Spain, Andorra-Sierra de Arcos Region, Teruel]

Coal Transition in Spain, Del Río, IDDRI and Climate Strategies, 2017, [link](#).

Good Practice Guidelines: Boosting the regeneration process of Europe's coalfield regions, RECORE, undated, [link](#).

Industrial Regions and Climate Policies: Towards a Just Transition? ETUC, 2016, [link](#). [Spain, Asturias]

The new social contract: A Just Transition, Change Partnership & FEPS, 2016, [link](#). [Spain, Bilbao in Basque region]

Bilbao Ría 2000 – Transformation of Bilbao, Spain through public/private partnerships, Sustainable Development Knowledge Platform, United Nations (undated), [link](#).

Sri Lanka

Managing the Transition to a Low-Carbon Economy Perspectives, Policies, and Practices from Asia Editors, Solar Thermal, Asian Development Bank Institute, 2015, [link](#).

Sweden

Effects of restructuring at regional level and approaches to dealing with the consequences, Eurofund, 2014, [link](#). [Sweden, Trollhättan, Western Götaland]

Power Sector Divestment – Vattenfall Lignite Asset Sale, Case Study, in Input Paper for the OECD Key Political Economy and Entanglement Issues of the Low-Carbon Transition in G20 Countries, E3G, 2017, [link](#).

Renewal of Mature Industry in an Old Industrial Region: Regional Innovation Policy and the Co-evolution of Institutions and Technology, Coenen, Moodysson, & Martin, *CIRCLE Paper 7*, 2013, [link](#). [Sweden, Örnsköldsvik and Umeå]

Ukraine

Good Practice Guidelines: Boosting the regeneration process of Europe's coalfield regions, RECORE, undated, [link](#).

United Kingdom

Coal Transition in the United Kingdom, Fothergill, IDDRI and Climate Strategies, 2017, [link](#).

Good Practice Guidelines: Boosting the regeneration process of Europe's coalfield regions, RECORE, undated, [link](#).

Industrial Regions and Climate Policies: Towards a Just Transition? ETUC, 2016, [link](#). [UK, Yorkshire]

Opportunities to tackle Britain's labour market challenges through growth in the circular economy, Morgan and Mitchell, Green Alliance, 2015, [link](#).

The New Social Contract: A Just Transition, Change Partnership & FEPS. 2016, [link](#).

Urban regeneration, digital development strategies and the knowledge economy: Manchester case study. Carter, *Journal of the Knowledge Economy*, vol. 4(2), pp.169-189., 2013. [UK, Manchester]

United Kingdom – Scotland

A transformational paradigm for marine renewable energy development, Graziano, Billing, Kenter & Greenhill, Energy research & social science, vol. 23, 136-147, 2017.

About Local Energy Economies, Community Energy Scotland, [link](#). [accessed 16.05.2018]

BIG HIT to make Orkney a model hydrogen territory (Report). Fuel Cells Bulletin. 14(2), 2016.

BP Statistical Review of World Energy, BP, June 2013, [link](#). [accessed 16.05.2018]

Climate Change, Scottish Government, 2017, [link](#). [accessed 16.05.2018]

Community And Renewable Energy Scheme - Overview of Support, Scottish Government, [link](#). [accessed 16.05.2018]

Data from Nomis website (Official labour market statistics), [link](#). [accessed 16.05.2018]

Demographic change in the Sparsely Populated Areas of Scotland (1991-2046), Copus and Hopkins, James Hutton, Institute's Social, Economic and Geographical Sciences, 2018, [link](#).

Economic Report 2017, Oil & Gas UK, 2017, [link](#).

Energy of Orkney, Orkney Website, [link](#). [accessed 16.05.2018]

Funders, The European Marine Energy Centre website, [link](#). [accessed 16.05.2018]

Green jobs increase, Scottish Government, 6 April 2017, [link](#). [accessed 16.05.2018]

Jobs after coal: A Just Transition for New Zealand communities, Baxter, Campbell, Eyre, Fitzsimons, Gillies, Downing, Jones, and Penwarden, Coal Action Network Aotearoa, 2015, [link](#).

Jobs in Scotland's New Economy, Minio-Paluello, 2015, [link](#).

Low Carbon Infrastructure Transition Programme - Supported Projects, Scottish Government, [link](#).

Marine renewables and coastal communities—Experiences from the offshore oil industry in the 1970s and their relevance to marine renewables in the 2010s. Johnson, Kerr & Side, Marine Policy, 38, 491-499, 2013.

Maximising Economic Recovery: The Wood Review, Energy Matters website, 2013, [link](#). [Accessed 16.05.2018]

Measuring the Local Economic Impact of Community-Owned Energy Projects. Entwistle, Roberts, and Xu, Gilmorton Rural Development and the James Hutton Institute, 2014.

Orkney Economic Review 2012-13, Orkney Islands Council, [link](#).

Orkney Economic Review 2015-16, Orkney Islands Council, [link](#).

Orkney Islands Provide A Glimpse Of A Renewable Future, Atlantis Resources, Sep. 2011, [link](#).
[accessed 16.05.2018]

Orkney Renewable Energy Forum (OREF) website, [link](#). [accessed 16.05.2018]

Orkney Sustainable Energy Strategy 2017/2025, Energy of Orkney, [link](#).

Renewables in Numbers, Scottish Renewables website, [link](#). [accessed 16.05.2018]

Second generation active network management on Orkney. Foote, Johnston, Watson, Currie, Macleman and Urquhart, 2013.

Scotland: A Renewable Powerhouse, WWF Scotland, 2013, [link](#).

Scotland's Place in Europe, Scottish Government, 2016, [link](#).

Scottish Planning Policy SPP 6 Renewable Energy, Scottish Executive Development Department, 2007, [link](#).

Scottish National Investment Bank, Scottish Government, 5 September 2017, [link](#). [accessed 16.05.2018]

The energy sector in Scotland's future, Hughes, *Oxford Review of Economic Policy*, Volume 30/2 Pages 374–391, 2014.

The future of energy in Scotland, Scottish Government, 24 January 2017, [link](#). [accessed 16.05.2018]

The potential impact of Brexit on Scotland's renewable electricity ambitions, Zeniewski, University of Edinburgh, 2017, [link](#).

The role of Ownership in Determining the Rural Economic Benefits of On-shire Wind Farms. Phimister and Roberts, *Journal of Agricultural Economics*, Vol. 63, No. 331-360, 2012.

Transition Training Fund, Skills Development Scotland, [link](#). [accessed 16.05.2018]

What is it like to study and live in Orkney?, Heriot-Watt University website, [link](#). [accessed 16.05.2018]

United States

Appalachia Then and Now: Examining Changes to the Appalachian Region since 1965, Appalachian Regional Commission, 2015, [link](#). [US, Appalachian Region]

Coal Transition in the United States, Kok, IDDRI and Climate Strategies, 2017, [link](#).

Jobs after coal: A Just Transition for New Zealand communities, Baxter, Campbell, Eyre, Fitzsimons, Gillies, Downing, Jones, and Penwarden, Coal Action Network Aotearoa, 2015, [link](#). [US, Appalachia, Kentucky]

Retraining investment for US transition from coal to solar photovoltaic employment. Louie and Pearce, Energy Economics, vol. 57, pp.295-302, 2016, [link](#).

Case studies: global

Economic Growth and Development with Low-Carbon Energy, Fankhauser and Jotzo, Grantham Research Institute on Climate Change and the Environment, 2017, [link](#).

ICT and regional economic dynamics: a literature review. Karlsson, Maier, Tripl, Siedschlag, Owen & Murphy; JRC Scientific and Technical Reports, Publications Office of the European Union, Luxembourg, 2010, [link](#).

World Economic Forum White Paper Digital Transformation of Industries: In collaboration with Accenture, World Economic Forum, 2016, [link](#).

Guidance

A Just Transition for all: Can the past inform the future? ILO, Geneva; International Journal of Labour Research, Volume 6, Issue 2, 2014, [link](#).

A Just transition of the workforce, and the creation of decent work and quality jobs, UN Framework Convention on Climate Change, 2016, [link](#).

A Stress Test for Coal in Europe under the Paris Agreement: Scientific Goalposts for a Coordinated Phase-Out and Divestment, Climate Analytics, 2017, [link](#).

Fuelling Europe's Future: How transition from oil strengthens the economy, Harrison P, 2018, [link](#).

Good Practice Guidelines: Boosting the regeneration process of Europe's coalfield regions, RECORE, 2006, [link](#).

Green Collar Nation: A Just Transition to a low-carbon economy, Davis, Garman and Pearson, Greenpeace UK, 2015, [link](#).

Guidelines for a Just Transition towards environmentally sustainable economies and societies for all, ILO, 2015, [link](#).

Impacts on Employment and Livelihood: Workshop on economic and social consequences of response measures, Sanchez, ILO, 2009, [link](#).

Input Paper for the OECD Key Political Economy and Entanglement Issues of the Low- Carbon Transition in G20 Countries, E3G, 2017, [link](#).

Instruments for a Managed Coal Phase-Out: German and International Experiences with Structural Change, Schulz and Schwartzkopff, E3G, 2016, [link](#).

Just Transition: A Report for the OECD, The Just Transition Centre and International Trades Union Confederation (ITUC), 2017, [link](#).

“Just Transition” - Just what is it? An analysis of language, strategy and projects, Labour Network for Sustainability and Strategic Practice: Grassroots Policy Project, 2016, [link](#).

Just Transition - Where are we now and what's next? A Guide to National Policies and International Climate Governance, International Trade Union Confederation, 2017, [link](#).

Lessons from previous “Coal Transitions” High-level Summary for Decision-makers, Caldecott, Sartor and Spencer, IDDRI and Climate Strategies, 2017, [link](#).

Setting an International Policy Agenda for Just Transition, Stanley Foundation, 58th Strategy for Peace Conference, *Policy Dialogue Brief*, 2018, [link](#).

Academic

Assessing social and economic impacts associated with changes in the coal mining industry in the Bowen Basin, Queensland, Australia. Ivanova, Rolfe, Lockie and Timmer; *Management of Environmental Quality: An International Journal*, 18(2), pp.211-228, 2007.

Effects of restructuring at regional level and approaches to dealing with the consequences. Prato textile district, Italy, Pulignano, Passarelli and Voss, Eurofund, 2014, [link](#).

Empowerment and the challenge of applying transition management to ongoing projects, Avelino, *Policy sciences*, 42(4), p.369, 2009, [link](#).

Estimating Socio-Economic Impacts of Mine Closure, Kemp, Clark and Zhang, Research Paper No. 8, CRSM and University of Queensland, 2008, [link](#).

It's not over when it's over: Mine closure around the world. Sheldon, Strongman and Weber-Fahr, World Bank and International Finance Corporation, 2002, [link](#).

Processes and patterns in transitions and system innovations: refining the co-evolutionary multi-level perspective, Geels, Technological forecasting and social change, 72(6), pp.681-696, 2005, [link](#).

Regional economic development: A review, Ascani, Crescenzi and Iammarino, 7th European Community Framework Programme, SEARCH WP, 1(03), 2012, [link](#).

The end of coal, how should the next government respond? The Green Institute, 2016, [link](#).

The Impact of Unemployment on Families, Broman, Hamilton and Hoffman, Michigan Family Review, Volume 02, Issue 2, pp. 83-91, 1996, [link](#).

The multi-level perspective on sustainability transitions: Responses to seven criticisms, Geels, Environmental innovation and societal transitions, vol. 1(1), pp.24-40, 2011, [link](#).

What is protective space? Reconsidering niches in transitions to sustainability, Smith and Raven, Research policy, 41(6), pp.1025-1036, 2012, [link](#).

Transition policy for climate change mitigation: Who, What, Why and How, Fergus Green, CCEP Working Paper 1805, May 2018, [link](#).

Other

China's laid-off workers pose daunting welfare challenge - Early retirement for 1.8m in coal and steel sectors imposes heavy burden on state, Feng, Financial Times, 2017, [link](#).

Community Assistance, Energy Gov. website, [link](#). [accessed 17/05/2018]

Facing uncertain future, fossil fuel workers want retraining in renewables, Voysey, The Conversation, 7 November 2017, [link](#). [accessed 17/05/2018]

How the FTSE 100 has changed over 33 years, Schroeders, 2017, [link](#). [accessed 17/05/2018]

Improving air quality, House of Commons, HC433, 15 March 2018, [link](#).

LFS: ILO unemployment rate: North East: All: %: SA, Office for National Statistics, [link](#).

Port Augusta can show the world what Just Transition for workers looks like, Guardian, 20 November 2016, [link](#). [accessed 17/05/2018]

Shenyang: A Home for German Companies, Shengyang Municipal Bureau of News, PR Newswire, 29 December 2016, [link](#). [accessed 17/05/2018]

Was ist los mit dir, Ossi? Gutsch, Der Spiegel, Issue 31, 2017, [link](#).

How computer automation affects occupations: Technology, Jobs and Skills, Bessen J, Boston University School of Law, Law and Economics Research Paper No. 15-49, November 2015

Bloomberg Philanthropies announces partnership with Powering Past Coal Alliance to strengthen global efforts to phase out coal, Bloomberg.org, 9 April 2018, [link](#)

Agulhas

Applied Knowledge

©Agulhas Applied Knowledge Limited 2018

For more information about this report or general enquires about Agulhas or our work, please contact us at:

Address: 10e Branch Place, London N1 5PH

Telephone: +44 333 700 0770

Email: contact@agulhas.co.uk

Twitter: @Agulhas_

Web: www.agulhas.co.uk