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Lessons from previous 'COAL TRANSITIONS'

HIGH-LEVEL SUMMARY FOR DECISION-MAKERS

Part of 'Coal Transitions: Research and Dialogue on the Future of Coal' Project

2017

Climate Strategies

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A project funded by the KR Foundation

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Cite this report as

Ben Caldecott, Oliver Sartor, Thomas Spencer, Lessons from previous 'Coal Transitions' High-level Summary for Decision-makers, IDDRI and Climate Strategies.

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This report benefited greatly from comments received from many individuals including the Coal Transitions Advisory Group, members of the research consortium and authors of other studies.

We would especially like to thank:
Case Study Authors: Pablo del Rio Gonzales, Ben Gales, Rick Huelsgens, Steve Fothergill, Irem Kok, Aleksander Szpor, Milan Ščasný
Other external reviewers: Jesse Burton, Hervé Casterman, Lars Coenen, Dave Collins, Michel Colombier, Henry Derwent, Frank Jotzo, Luke Kemp, Grzegorz Peszko, Henri Waisman, Harald Winkler.

Publishers: IDDRI and Climate Strategies
Editors: Pierre Barthélemy, Andrzej Błachowicz, Germana Canzi, Alexandra Carr, Oliver Sartor, Thomas Spencer
Graphic design: Ivan Pharabod

‘COAL TRANSITIONS’

National case studies

This report was based on the following case studies of historical coal mining transitions, which were produced under the project: Coal Transitions: Research and Dialogue on the Future of Coal. The country case studies can be found on the Coal Transitions project website: *https://coaltransitions.org/*.

These publications were prepared with the generous support of the KR Foundation:

- **Del Río, P.** (2017). *Coal Transition in Spain*, published by IDDRI and Climate Strategies, Paris and London.
- **Fothergill, S.** (2017). *Coal Transition in the United Kingdom*, published by IDDRI and Climate Strategies, Paris and London
- **Gales, B. & R. Hölsgens** (2017). *Coal Transition in the Netherlands*, published by IDDRI and Climate Strategies, Paris and London
- **Kok, I.** (2017). *Coal Transition in the United States*, published by IDDRI and Climate Strategies, Paris and London.
- **Rečková, D., L. Rečka, M. Ščasný** (2017). *Coal Transition in the Czech Republic*, published by IDDRI and Climate Strategies, Paris and London.
- **Szpor, A.** (2017). *Coal Transition in Poland*, published by IDDRI and Climate Strategies, Paris and London.

The authors of this report wish to thank the authors of these case studies and their respective institutions for their excellent work.

Content

Introduction

The stabilisation of the climate system in line with the Paris Agreement on climate change is impossible without the timely phase out of unabated coal from the global energy system. Coal currently accounts for 29 percent of global primary energy supply and generates 44 percent of global CO_2 emissions (Center for Climate and Energy Solutions n.d.). Carbon capture and storage technologies notwithstanding, this transition implies a substantial reduction in global coal demand (Allen *et al.,* 2014).

Phasing down the use of coal is also increasing looking feasible and politically desirable in large parts of the world. Alternative energy sources, such as onshore and offshore wind and solar photovoltaics (PV), are constantly improving in terms of cost competitiveness with coal in many locations (Randall 2015; Liebreich 2015). These alternatives also have important co-benefits, such as producing much less local air pollution that impacts human health (Health and Environment Alliance 2013), and using significantly less water (Rodriguez *et al.*, 2013; Greenpeace Energydesk 2016). Improvements in the cost of energy storage and other approaches to managing intermittency–a common retort to the possibility of significant fossil fuel phase out–have also gathered pace.

A phase down of coal use in line with global climate objectives will require major adjustments on the supply side of local and global coal markets. In an uncertain world, it also has to be acknowledged that the adjustments to the supply side of global coal markets could come faster and less smoothly than workers, companies and regions currently expect. If recent experience of global energy markets–whether for electricity, oil, gas, nuclear or renewables–has taught us anything, it is that "structural breaks" in the market environment often occur faster and can be more disruptive than key actors think is possible until they actually occur. This is also a lesson from the case studies summarised in this paper: the economics of coal mine closure can move quickly, often leading actors to try to catch up to the unfolding reality, rather than piloting their own future. When this occurs, the results are often much more severe for companies, workers and regional communities. Getting ahead of economic realities is crucial.

Moreover, the global nature of coal markets means that local coal mining activities in specific parts of the world can also be strongly affected by international developments that occur beyond national borders or the control of national governments. Likewise, the opposite holds true: domes-

tic national or regional developments, particularly those in major coal consumers, can have significant impacts on global markets and hence on exporting regions. Thus, there is strong argument for anticipation of coal sector transition.

However, these adjustments come with important challenges and risks. Most immediately, these challenges and risks are borne by workers, companies, and regions, each of whom currently depends on the economic activity generated by coal mining in different ways. Workers face risks related to finding desirable reemployment or, for some, managing their exit from the labour force; companies face reputational, financial and strategic risks; while regions will often have to adjust to the loss of a significant share of their local economic activity in local communities. Indeed, some of these risks have already begun to be felt in specific contexts, such as in China, Europe and the US, where the plight of coal companies, regions and workers has become an important pre-occupation of governments (Wood Mackenzie 2016; Krukowska 2016).

The way that these risks are managed is vital to ensuring the best possible outcomes for these actors and the people who stand to be affected indirectly. Given the importance of the issues at stake to specific stakeholders, it is imperative that they are addressed fairly and effectively. Moreover, from a political perspective, these local challenges, if not addressed well, can also take on a global dimension: most obviously they can also have potential feedback effects on the willingness of populations and their governments to undertake necessary action to phase down the use of unabated coal (Caldecott *et al.*, 2016; Caldecott *et al.*, 2017) and pursue climate policy more broadly.

These considerations have led to the acknowledgement of the need for a so-called "just transition" away from carbon intensive activities, such as coal production and use. But what might a just transition look like in practice? What specific risks need to be managed and what are the best approaches to managing them? There is an urgent need to develop a deeper understanding of these issues.

It is to this need that this report tries to respond. It provides a summary of lessons from six historical case studies of regional coal mining transitions that have occurred or are ongoing in Europe and the United States in recent decades (see **Table 1**).

Table 1. Case Studies Analysed

Czech Republic - **Several locations**
Collapse of Soviet Union and shift to market-based economy

- Main period of decline: 1990 to 2000
  Broader period examined: 1990 to present day
- 120mt in 1990 to ~60mt in 1998
- 160,000 to 60,000 in 2000
  Declining to ~33,000 in 2014

Netherlands - **Limburg region**
Full mining phase out

- Mine closures: 1965-1975
  Regional restructuring: 1965-1990
- 11 mines - Decline in production of ~14 Mt coal (~85% decline nationally)
- ~75,000 jobs

Poland - **Upper Silesia, Małopolskie, Lubelski**
Fall of Soviet Union & transition to market economy

- Main period of output decline, closures and restructuring: 1990-2002
- Closure and consolidation of 70 mines into 30
  Decline of 147 Mt to 106 Mt hard coal output from 1990 to 1999
- ~380,000 to 150,000 jobs from 1990 to 1999

Spain - **Several locations**
Declining competitiveness with imports, depletion of brown lignite, diversification of electricity mix

- First period of decline: 1985 to 2008
  Second period: 2008 to 2015
- 39mt/yr in 1985 to 4 Mt in 2015
- 32,000 jobs in 1993 to 3,715 jobs in 2014

United Kingdom - **Numerous locations**
Decline of UK coal mining industry due to economic unprofitability and cessation of government support in 1980s

- Main period of decline: 1980-1990
  Broader transition period: 1980 to 2016
- 130mt/yr in 1980 to 4mt/yr in 2015
- 237,000 to 49,000 (1980-1990)
  Declining to 1,000 in 2014

United States - **Appalachian and Powder River Basin**
Gradual decline due to multiple factors

- Main period examined: 2008-2016
  Longer-term trend: 1970s-2016
- Decline of national coal production by 23% in 8 years to 2015
  Appalachia: -37% from 1990 to 2008
- 220,000 to 65,000 (1980 to 2015)
  85,000 to 65,000 (2010-2015)

Legend

Country - **Region**
Reason for transition

- Period
- Decline in production
- Decline in employment

These case studies and this report were developed as part of a broader project led by IDDRI and Climate Strategies, entitled "Coal Transitions: Research and Dialogue on the Future of Coal". This project seeks to utilise these historical lessons to facilitate the development of feasible coal transition scenarios in large coal producing countries today, with a focus on Australia, China, South Africa, Germany, Poland and India.

General Observations on the Case Studies and their Relevance to Coal Transitions Today

The case studies examined here typically reflect cases where mining activity declined and industrial restructuring has occurred in response to exogenous economic and technological shocks. These past closures have not been the result of climate policy. This has implications for the kinds of conclusions that can be drawn.

On the one hand, these case studies provide important insights with clearly transferable experiences and lessons. One gets a strong sense of the various dimensions of industrial restructuring transitions that are important, the issues that tend to be addressed or neglected, the risks and incentives faced by different actors, common policy mistakes, the potential for social conflict and its consequences, the role of relative bargaining power, common policy solutions and their effects, and the potential consequences for key actors (whether individuals, companies, regions, governments). Among other things, this allows for a number of key variables to be identified that appear to help to make for either relatively successful or relatively unsuccessful transitions, and gives some insights on specific policies.

On the other hand, the coal transitions studied in the six case studies are–with the possible exception of the Dutch case study–also quite different in nature to the kinds of transitions that might be expected to occur due to climate or other environmental policy goals. In most of the case studies, the pure economic reality was something that was already (relatively) clear for most actors to see. Examples of this include the collapse in demand for coal in Poland or the Czech Republic in the wake of the collapse of the Soviet Union, the inexorable rise of shale gas in the US, or the discovery of gas in the Netherlands.

This has important consequences for policy strategies. On the one hand, it means that certain key questions for today's coal transitions were already "dealt with" in a certain sense. Most obviously, the question of "whether and why to transition?" did not have to be tackled collectively. This question matters because of the potential for social and political conflict around the transition–particularly in today's climate of political populism that is, to a large extent, an expression of disaffection with the priorities of policy makers and political elites. The question of how to engage the transition and have the transition as something that is *chosen* by key stakeholders and how to do so in different contexts is therefore a crucial question raised–but not satisfactorily answered–by the case studies. This is therefore a crucial question for future research and policy reflection.

Another possible limitation of the case studies is that, because they were transitions that were forced by external factors, there was typically–with the exception of the Netherlands–very limited actual anticipation, strategy and proactive management of the transitions. Consequently, the synthesis provided here cannot necessarily provide a systematic analysis of "which policies and strategies work", since to a large extent, policy and strategy was often relatively limited. Nonetheless, the

examples from the case studies–and the one exception of the Netherlands–clearly show the importance of anticipation and of proactive management of the transition. More analysis of actively planned industrial-regional transitions and factors for success is therefore another crucial question raised by the report.

Finally, there may be important differences between domestic contexts in the European countries studied here and the developing economies that today are often large coal producing countries. Nonetheless, these specific case studies were chosen for three reasons. Firstly, because of the abundance of available information on the transitions and policies used. Secondly, because the richness of experience across the specific countries studies already enables us to draw deeper lessons about "what matters". These are likely to be relevant across different jurisdictions and economic models. Furthermore, the purpose of these case studies is not to provide specific policy recommendations to any one national transition. Rather it is to develop a broader conceptual framework and set of insights that are likely to be relevant across different contexts.

The remainder of this report begins with a summary of the main high level policy recommendations from the six case studies and related literature on industrial transitions. It then provides further in-depth discussion of specific policies in relation to managing the consequences of transition and with respect to regional restructuring. The report concludes by highlighting some remaining knowledge gaps that are not addressed in this report.

Main Insights and Recommendations

General Remarks

A strong lesson from the historical examples of coal transitions that they are difficult processes, and can often leave long-lasting effects on individuals, regions and sometimes companies. There are certain factors that make the closure of coal particularly challenging from a political economy perspective. These include:

- **Geographical concentration – coal production is highly concentrated, often in areas dependent on coal mining as the main economic activity.** Coal closures therefore have a very significant impact on local and regional economies.
- **Identity – related to geographical concentration is the fact that coal producing regions develop a cultural identity linked to the predominant economic activity.** This means that coal closures are not just a question of what is economically efficient or rational, but bound together in individual and cultural identities and identity politics.
- **Labour mobility – the ability of labour markets to act as economic shock absorbers, helping those made involuntarily unemployed find work in other sectors, varies between geographies and is constantly evolving.** There is growing evidence to suggest that labour mobility, even in highly integrated countries with very flexible labour markets (e.g. the US and UK), is becoming less effective as a shock absorber than tended to be assumed by trade economists in the 1990s (Coe 2009).
- **Human capital – coal miners often suffer from skills shortages and this is partly due to a lack of educational opportunities in many areas.** This makes it harder for them to participate in labour markets after redundancy. It also has implications for the ability of regions and subsequent generations to adapt to coal closures.

An implication of the case studies is that any attempt at managing a regional transition away from coal mining is a large, challenging and multifaceted task. Transitions often span multiple decades. Indeed, many of the tran-

sitions identified in the case studies that begun decades ago are still ongoing (e.g. in Spain) or have only recently ended in terms mining (UK). Only the Limburg region–a transition that began in 1965–can in a sense be said to have finished its "transition" (at least this is the case in terms of dedicated reinvestment in the region via national and EU funds). The time scales involved raises important questions in terms of the speed with which, for instance, climate policy induced, coal transitions will need to be engaged today if they are to be given a chance to succeed.

The scale of the transition for workers from mining to alternative activities (or indeed out of the workforce) can also be significant. For instance, in the southern Polish case study, approximately 230,000 jobs left the mining sector in the space of 9 years. In the Dutch case, 75,000 jobs in a similar 10 year time frame and in the UK, 188, 000 mining jobs disappeared during the 1980s alone. Compared to the size of regional labour forces, and especially compared to the size of regional labour demand for workers with miner's educational level, these numbers were typically very large. Today, mining in developed countries tends to employ fewer workers than was the case in the beginning of many of these transitions. Nonetheless, the regions in which these mines operate can be isolated and therefore the employment numbers can be high relative to local alternatives. In developing countries, however, similar scales of employment per mining location to those examined in the case studies can be found.

For other actors also, the scale of the challenge is significant. For regions, the scale of the challenge in terms of lost economic activity and lost demand for related services and businesses can also be very important. For companies, there may be risks to corporate reputation or to corporate profitability more generally. Forexample, in the US, 25 different mining companies were bankrupted during the transition of the Appalachian Basin. In the short term, coal transitions have often involved significant social conflicts. In the UK case, hunger strikes, violence at picket-lines and significant social protests were not uncommon. In Spain, similar protests have occurred as recently as 2012 in relation to government restructuring plans. In other cases, such as the Netherlands and Poland, conflict or the threat of social conflict has also played an important role in affecting the outcome of worker compensation packages. (This has generally occureed where unions have been stronger so short-term compensation has been higher, but former workers or regions have not necessarily been left better off in the longer term.)

In the longer term, all of the coal transitions studies have left long-term effects on specific regions, often with high dependency ratios (non-working to working population), low educational attainment, below average wages and wage stagnation, environmental problems related to site remediation, etc. This often appears to be a legacy – at least in part – of a failure to anticipate and prepare for the transition. The scale of the challenge therefore mustn't be underestimated.

The Importance of Anticipation

Because of the large scale and complexity of the challenges to be addressed, the earlier that actors (i.e. workers, companies and regions) anticipated, accepted and began to implement steps to prepare and cushion the shock of the transition, the better the results.

As **Table 1** (above) shows, past regional coal mining transitions have often seen very significant drops in employment in a period of 10 years or less. Transitioning thousands of employees out of mining and into jobs of equivalent qualification levels, or into retirement, in short periods is not realistic; especially where the geographical concentration of mining activities means that there may be limited economic opportunities that are appropriate in the immediately surrounding area in the short term.

Similarly, regional economies typically cannot easily replace a large share of economic output and local tax revenues that fund local services, in short order. In the Limburg region of the Netherlands, for instance, the allocation of EU structural investment funds to help rebuild the regional economy only officially ceased in 1990 (25 years after the beginning of the transition).

Even companies may find it difficult to manage a transition out of coal mining where it is a significant part

of their existing business activity, since it implies developing new business models and this also takes time.

However, psychological acceptance of the changes that are unfolding and their implications are not necessarily simple either and these also take time. For workers and individuals in local communities there are often important questions of identity and self-esteem linked to their existing professional activities, the current set-up of the community, and the social and family networks that depend economically on mining or related activities. It can take time for people to simply accept the extent of the disruption that will occur before they are able to plan and proactively develop alternatives.

Finally, anticipation of the transition is important because, as in the past, when future coal transitions do occur, they could happen quickly. As noted earlier, global markets are global, and shifts in demand for coal (even if it originates in another country) can potentially have very sudden repercussions for coal producing countries and specific regions within them. There are also various factors that could plausibly contribute to unexpected shocks to the demand for coal, whether they are continued declines in renewable energy and battery storage costs, air quality crises in specific countries, water shortages or policy responses to growing evidence of climate change.

It is important to bear in mind that the bulk of the effort to implement the energy transition required to tackle climate change will need to take place in the coming 20 to 30 years. This in turn implies that coal producing countries and regions have very little time left to begin to prepare their transitions out of mining.

Common vs Divergent Interests in Accepting and Anticipating the Transition

As highlighted above, coal transitions present very significant risks for companies, regions and workers, so anticipation can help to mitigate those risks. However, this raises the question of why actors should want to work together to implement a transition in the first place? A fundamental question raised by the case studies, especially for climate policy related coal phase outs, is how to motivate actors–the workers, companies, regions and governments–to collectively choose to anticipate and implement transition a transition strategy, and, linked to that, to fulfil certain responsibilities that facilitate the overall transition for other parties.

One possible answer to this question is that the risks for different actors are real, non-negligible and high. Moreover, the risks for workers, companies and regions can also be interdependent in some important ways. For workers, a stronger company balance sheet is more able to offer better terms for employee transition, retraining or labour force exit. For example, the US case study showed that when the companies are bankrupted by an adverse economic situation, workers can lose vital benefits such as health care coverage and pension funds, as well as jobs.

For companies, more satisfied workers and regions means that potentially important reputational risks, not to mention financial risks of industrial action, can be avoided. The lack of industrial strike action in the Dutch case appears to have been in part due to the fact that workers unions were promised new employment for all workers that wanted to remain in the workforce. Furthermore, since many workers were to be retrained and mobilised within new activities being developed by the company, there was a union interest in supporting the company's overall commercial strategy and economic health.

For regions, as well, the well-being of the former workers and the company's balance sheet is also crucial for managing adverse economic or social impacts, re-investment in new local businesses or services, and ensuring environmental clean-up and site remediation. Indeed, a very striking feature of almost every case study was that governments would almost systematically pick up a large share of the cost of the transition. Often, this was because companies found themselves in such dire straits economically, that the government's hand was forced to avoid an even more abrupt economic collapse.

The strong interdependence between the interests of companies, workers and regions suggests that these actors should in principle have a strong incentive to work together and find consensus on a mutually acceptable transition strategy. Moreover, the complex and multi-faceted nature of the transition means that any effective exit strategy will need to be based on in depth and close cooperation between different stakeholders on their respective needs. This is ideally a bottom-up process, shaped by local communities and their leaders with in-depth knowledge of local situation.

However, while these common interests exist to a certain extent, there is also ample evidence of conflict, failure to anticipate an exit strategy, and companies in particular, privatising gains and socialising the losses of their activities under the protection of bankruptcy (cf. US case study). Moreover, some of these "common interests" in a successful transition play out in different time horizons. Forexample, while some companies may care about reputational risks, this is likely to be more important to them when operating on domestic rather than foreign soil. Alternatively, a rational self-interested strategy for a company may be to sell the site to a less responsible company just before the obligations of transition arrive.

Perhaps the most interesting example from the case studies in this respect was the Limburg case, which was remarkable for the relatively consensual nature of the transition between unions, company and government. In this case, there were no social demonstrations or industrial action throughout the entire transition. Part of the unusual consensus seems to have come from the general recognition among different parts of the community that a new energy source had arrived (in natural gas) and the "rules of the economic game" had fundamentally and irrevocably changed. In a sense, the future had arrived and the challenge was a collective one for different actors (workers, company, region, etc.) to adapt.

However other factors seem to have played a role. One seems to have been the arrival of a new government at a crucial period in the preparation of the transition, which had a relatively good relationship with the unions (compared to the previous government), and which was more or less trusted when it promised no transition without new jobs for all workers that wanted them. Furthermore, a key factor in the consensus appears to have been that a possible alternative future for the company and the region seemed to exist – at least to a certain extent – in the minds of different actors if they went along with the government's plan. For the company and many workers there was the promise of government support for expanding local chemical production activities and new gas exploitation concessions (for the company). For the region, a strategy built around central government support for the transition and sponsoring the arrival of industrial networks also appeared a credible strategy. All this meant that there were some common elements of an exit strategy that could be acceptable and which created a credible reason for different actors to accept and cooperate with the transition strategy.

Who Pays?

The preceding discussion on the roles of different actors in turn raises an important implicit theme throughout the case studies–*which is who should pay for the transition*?

In many cases, governments ultimately invested significant sums in supporting company profitability (e.g. through per unit coal sales or similar subsidies, taking on debt obligations or site remediation costs), payment for liabilities owed to workers (e.g. pension funds, worker compensation packages, worker training and relocation, etc), and to regions to attempt to stimulate economic growth.

Systematic and detailed data on the costs of the transition borne by central and regional governments, companies, workers and individuals in the region, are unfortunately not offered by the case studies. However, it is clear that the sums can be large–often in the order of several billions of today's Euros–and that a large part of the cost is borne by central or regional governments (even where companies were state owned). For instance,

in the Limburg case, approximately 11.6 billion Euros (in today's prices) was spent on national subsidies by the national government alone (not including several 100 million per year in EU funds to the region by the end) for the purposes of supporting coal prices and regional reconversion. Unfunded costs of site remediation and the social costs of mining activities dating back to damages 50 years ago also remain. One estimate also suggested that in the Dutch case, all told, regional reinvestment in new economic activities also cost about 300 to 400 000€/per long-term job created. The sums are therefore significant.

At the same time, the case studies clearly show that the cost of not supporting a transition can be much higher that the costs of the transition. For example, in the Spanish case, approximately 22 billion € is estimated to have been spent in government subsidies just on supporting the profitability of mining activities between 1992 and 2014 (1 bn €/yr on average), i.e. independently of any transition. Historically, payments were often higher in previous periods. In Spain, it is estimated that the average cost of supporting each mining job implied by these payments was in the order of 250 000 € in total over the period 1998 to 2014. Similar kinds of payments to unprofitable coal mines prior to and during transition also occurred during the transition in Poland, Czech Republic, UK and the Netherlands.

Moreover, many of the case studies highlight that poorly managed transitions can lead to workers retiring completely from the workforce at abnormally young ages, with concomitant impacts on the costs of social security and pension systemsIn Poland, a follow up study of the employment profiles of workers in the 1990s transition period suggests that five years later, approximately 30 to 40 percent of working age former workers were no longer active in the workforce. Similarly in Spain, the average age of retirement from the workforce of former miners was an abnormally low 44 years, while pension payments were often significantly more generous than national averages for equivalently paid and skilled workers. A back of the envelope calculation, for instance, would imply that a former mining worker retiring at 44 and in 2015 due to the absence of alternative work would potentially cost an additional 454 000 € to the state prior to normal retirement age, than a worker who found another job. It is also worth noting that the costs to the state can often extend beyond the cost of supporting former miners, since there are typically broader economic activities that also decline when a coal mine itself declines.

A clear implication of the analysis is that the aggregate social costs to the state of a failure to invest in the transition of workers and regions are often much higher that the costs of not investing from an overall societal perspective. In a context of fiscal belt-tightening, austerity and limited state capacity to provide adequate services to citizens, such considerations suggest that forcing actors to prepare for the transition is also prudent economic and fiscal policy.

A second implication of the analysis is that governments – whether regional or central–and indeed other stakeholders, need to think about what a just distribution of benefits and costs from mining activities should be. A clear theme of the case studies is that companies often tended to privatise many of the gains and socials many of the losses/liabilities from activities. The inability of US companies for example, to fund pensions or health costs for workers in a secure way, i.e. independently of the companies own financial fortunes, is one good example of this. Another is that companies - even allowing for the fact that many companies were state owned – tended to not fund important indirect costs of their activities like site remediation.

While mining companies in some cases also invested in their regions, such as in the Poland case study, the question remains as to how it was possible in so many cases region to fail so poorly to prepare for economic life beyond mining and thus be economically incapable of experiencing a smooth transition. This appears to raise fundamental question, especially for regional stakeholders, about how well they were able to extract and exploit mining revenues to generate a diverse and robust economic environment capable of transitioning away from mining when the time comes. The case studies do not fully answer this question. Nonetheless, stakeholders with long-term investment in local communities or mining activities appear to have an interest in ensuring that companies and governments (whether regional or central) are making the appropriate preparations and allocating costs and benefits of mining in a fair and just way.

Tailoring Exit Strategies to Local Circumstances

There were some common themes from the case studies in terms of policy approaches. For instance, many case studies highlighted the deceptive attractiveness but limited effectiveness, even of relatively generous "golden handshakes", for former workers. The limited effectiveness of some retraining policies – typically because of a mismatch between trained competences and local employment demand – is another common theme.

Nonetheless, a key theme from the case studies is that local circumstances matter greatly. For example, the territorial concentration of mining and the relative economic weight of mining and related services versus other economic activities make a significant difference to the ability of the region to absorb the decline in mining investment and employment. In some cases, the weight of mining in the local economy may be so great, and the distance from other economic centres of activity so far, that if there is a lack of other sources of comparative economic advantage for the region, then "managed retreat" may be most realistic option.

In other cases, closeness to regional economic centres, and/or other potential forms of comparative advantage may enable–with the right mix of policy support and sustainable economic opportunities–some degree of economic regeneration over reasonable time horizons.

For example, experience suggests that some coal fields in the UK or Netherlands were not beyond economic, social and environmental regeneration. For example, the evidence on employment in English and Welsh coalfields suggest that that the number of jobs in the coal industry fell by 225,000 between 1981 and 2008 but that the number of male jobs in other sectors in the same places increased by 180,000. This is clear evidence of successful economic regeneration. At the same time, experiences differ across specific regions. In regions where coal mining activities were smaller and where the local economy has prospered thanks to other activities, such as in Kent and parts of the Midlands, employment creation as a whole has held steady. In other more remote areas, such as Ayrshire, Northumberland and south Wales, job regeneration has been less impressive. These cases therefore have very different implications for policy.

More generally, successful restructuring can be guaranteed only by a complex regional revitalisation which includes such issues as transport, environment, health and social protection. This regional revitalisation, in ideal conditions, is a bottom-up process shaped by local communities and their leaders, with in-depth knowledge of local situation. Even basic things like concentration of mining activities matter. This militates in favour of consensus-driven dialogue with local actors and against the application of one-size-fits-all policies based on "best practice" formulae.

It also needs to be acknowledged that, depending on their characteristics, different regions will have different potentials to absorb all of the unemployed workers or to fully recover the economic losses related to mining by investing in new industries. This also implies different strategies, in terms of retraining and re-employment, or regional economic strategies.

The case studies also suggest that the reasons and "discourse" legitimating the transition can matter in terms of stakeholder buy in and this suggests another important role for local circumstances. For example, in the UK, the transition was famously conflictual and this appears to have contributed to the severity of outcomes for the workers and regions in the regions. In Spain, a similarly conflictual relationship between government and workers appears to have promoted an undesirable situation being continued with short term solutions that are expensive and unsustainable. In the Dutch case, or even in the Polish and Czech cases, a fundamental and broadly visible change in external circumstances (either of political, economic or technological nature) appears to have helped to legitimate the transition.

In the context of climate policy driven coal transitions, one can perhaps also imagine that legitimating discourses for transition may need to be different in different cases. For instance, cases where local lignite is used for local electricity production may be very different than cases where coal mining essentially serves global export markets. In the former case, local communities may resent external–e.g. national level–policy makers interfering in local communities in

a way that is seen as a continuation of the misguided intentions of "globalist agendas". In the latter case, the communities are already participating in the global market-place and might therefore be able to accept arguments that have their basis in global shifts in policy, economics, etc.

Human Capital

As the author of the UK case study points out, one of the challenges for regions is also that "if large numbers of jobs are lost from an area it creates a job shortfall in the local labour market that has the potential to persist over many years. The ex-miner may find new work, but if there are not enough jobs in total he will often do so at the expense of another local jobseeker, thereby transferring unemployment from one individual to another. A father may welcome redundancy as his employer closes, but that job is no longer available for his son or daughter." This was a common theme across the case studies; with often persistently higher unemployment occurring in former coal mining regions, even after many of the former miners would have reached retirement age or quit the workforce. For instance, across the UK coalfields as a whole in 2012 there were just 50 jobs for every 100 residents of working age.

This means that mining transitions can potentially have strong cross sector or even cross-generational impacts on employment, but then in turn on values, health, educational attainment, and potentially social cohesion. For this reason, regional economic regeneration and strategies to break a potential vicious cycle of economic and social disadvantage in former mining regions is arguable the most important aspect of any transition strategy.

However, based on the case studies examined, this is perhaps one of the most neglected parts of historical coal transitions. Indeed, often times the actors in historical coal transitions appear to have focused too much on purely economic distribution questions and too little on broader human dimensions and risks. For example, the UK case study, discussions at the time of closure focused on redundancy payments. However, despite large closures in the early to mid 1980s it was not until the 1990s and indeed then not until 1997 that a change of government led a significant level of investment in economic regeneration of former mining communities. In the US also, a key issue of debate has been unfunded pension and health care liabilities for former workers. However, Federal funds to support economic regeneration of former communities in the massive region of the Appalachian coal mining area were a meagre 75 million USD to date.

In part, this appears to be a consequence of transitions where economic realities overtake the capacity of the actors to think long term. The transition then can be reduced down a kind of zero-sum game where companies and unions try to use their relative bargaining power to obtain maximum financial advantage.

The more complex reality is that industrial transitions can have important ramifications for vital dimensions of human well-being, that can't be reduced to financial compensation packages. This is especially so for workers and the individuals living in affected regions.

Particularly important issues for workers tend to be managing the risks of a loss of professional pride, socio-economic status, and personally identity that is tied to their wage level, profession responsibility and role in a specific company, the family and the social networks that are part of the economic life of the community. These factors can be different for workers at different stages of their career. 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. This is often exacerbated by the lower wages and lower levels of responsibility that can be found in alternative jobs. A consequence is often that large numbers of miners prefer to leave the workforce at a young age, preferring to live on disability or long-term unemployment benefits than seek new work.

As demonstrated in the UK and Polish case studies, the scale of this hidden unemployment can be very large. For example, in the UK case, in the former coalfields, the incapacity claimant rate averages between 8 and 9 percent of all adults between the ages of 16 and 64,

peaking at 11 percent in the large south Wales coalfield. This compares with a national average of 6 per cent, and a claimant rate as low as 3 per cent in the most prosperous parts of the UK. Follow up studies in Poland also suggested that as many as 30 to 40% of former miners of working age were either unemployed or not participating in the workforce 2 years after leaving mining activities. These numbers highlight the fact that while governments may face high economic costs and political risks to investing in a transition for mining communities. The economic, social and ultimately political costs of failing to invest are likely to be very high.

Helping workers with health problems, advanced age and low educational ability to find work is a part of this crucial challenge. For instance, the UK case study noted that workers with anyone of these characteristics can struggle to be competitive in the labour market, but miners can often suffer from all three. Specific policies are therefore needed to address this aspect of the challenge. An interesting example in this regard is given by the Limburg case study, where a) the government essentially promised to give a job to any former mining worker who wanted it and b) the company DCM agreed to retrain but also keep a large share (approximately 1/3 of the workforce to employ in new jobs in the company). This meant that, in contrast to the UK or Polish cases, most workers were never separated from the workforce and thus the risk that they would fall into long-term unemployment (when confronted with the sheer scale of the challenge) was limited.

Different Time Horizons

A common theme across the case studies is that planning is an essential element managing a transition away from coal mining for a region, company or workforce. Planning is important for anticipating and developing strategies in response to the various risks raised above.

However it is also clear that there can be several aspects of a transition that, while they all need to be anticipated and begin being implemented as early as possible, they also need to be managed with different time horizons in mind until. This also has different implications for policy, institutions, financing and the assumption of responsibilities by different actors.

Three overlapping parts of the transition need to be planned. A first, which might be labelled, "*Preparatory action*", it is necessary to try to begin to create the expectation and acceptance that the transition is happening, that significant change will occur, and that action is needed to begin to adapt to it. This phase can thus allow key actors to begin to implement specific decisions that will help them cushion the shock of the transition.

For instance, for workers, this might involve mean pursuing internal mobilisations within the company to develop new skills in non-mining activities prior to redundancy; for companies it may mean encouraging workers to develop new skills and prepare for careers beyond mining, training support for relocalisation to a new business activity within the company, ceasing to hire workers who will be in the danger age of 35 to 45 when the workforce will be scaled back or, in hiring decisions, hiring workers on temporary contracts so that false expectations are not given to workers that a long-term career is possible at the site.

For regions preparation may mean disentangling regional government budgets from the assets and liabilities of the mining company, approaching central governments for help. It may also mean beginning to strengthen and cultivate investment in new economic activities and sources of long-term employment (particularly with miners and their sons and daughters in mind).

For regional or central governments, the transition may also mean hypothecating funds for regional economic restructuring and worker transition, e.g. by putting in place new taxes on mining activities to pay for transition, etc. This occurred in the Dutch case for instance, where a royalty on new gas sales was used to pay for the transition. Beginning dialogue between key stakeholders on the transition strategy, putting in place agreements or tools to ensure that different stakeholders fulfil their responsibilities (e.g. that companies do not sell the site and leave the challenge of the transition abruptly to someone less scrupulous). Etc.

In a second phase, it is important to implement *the economic phase down of activity and of employment*. In this phase, it is important that action takes place in a controlled and measured pace, but that the decision to phase down and close activities on a given timeline is also clear and unquestioned. In general, the more gradual are the reductions in activity and employment, the easier it is for the (more limited) supply of redundant workers to meet a real economic demand for their labour (or to exit the workforce at the normal age). Similarly, slower declines in mining activity can help local auxiliary industries to divest and scale down with less disruption. More time is also possible for the region to develop alternative sources of investment and economic activity. In general, even a small site may need 10 years to do this process optimally.

Finally, there is a third and longer time horizon which relates to issues like the management of the remediation of the mining site, the restructuring and re-invention of the economic model of the surrounding region, and also dealing with the potential intergenerational consequences of a declining industrial region. Here, issues such as, investment in educational opportunity, infrastructure and access to economic opportunity, and, where possible, the development of clusters of activities exploiting–to the extent possible–alternative sources of regional comparative economic advantage should be the focus.

In the context of climate change policy, where a significant reduction in coal activities is necessary in the coming decades, the implication of these conclusions is that necessary time to prepare and implement the transition properly is in extremely short supply. Thus, if they have not done so already, coal mining or using regions face an urgent need to start straight away in preparing and implementing the first steps of their transitions.

Managing Uncertainty

A strong theme emerging from the case studies is that when there is a failure to anticipate and prepare for the transition with sufficient lead time, "economic realities" can overtake the process and limit the range of options for different actors. For instance, in the Polish, Czech and UK cases, and even in other case studies, the combination of a structurally unsustainable situation and a rapid change in economic fortunes meant that the possibility of a controlled staged management of the labour force out of coal mining and into other jobs was impossible. As a consequences, regions and in several cases company shareholders (whether public or private) suffered the consequences.

An implication of the importance of not being overtaken by adverse economic or other realities is that "uncertainty" is not necessarily a good reason not to begin to develop and implement an exit strategy. Many of the transitions that occurred were linked to events that were far from certain when they occurred. In the Dutch case, that in which the results were the best, the author notes that the company was far from sure of the medium term economic prospects for its coal operations–with very different views within the company–at the moment where it decided to phase down its operations. The decision, however, was taken nonetheless because there was a general consensus on the need to diversify its activities in the face of new gas discoveries, and a potentially difficult coal market, while it had the chance. In practice this meant choosing a new alternative that was desirable and making that the focus of the strategy before all the facts are clear.

Governments also need to be proactive in the face of uncertainty. For instance, all of the case studies revealed that significant policy changes were made during the transition periods as governments reacted to unforeseen events. Even in successful cases, such as Limburg, investment in new industries in a region is, like any economic venture, a risk and not always successful. Mistakes, and adjustment to them, through on the ground learning needs to be anticipated, tolerated, monitored closely and actively managed. This raises important questions for further work in terms of how such monitoring and tolerance of mistakes is done best? This in turn relates to the role of specific institutions, the role of local vs national governments in allocating funds, monitoring tools, etc.

Specific Policies - Managing the Consequences of Closure

This section complements the general observations described above and discusses some of the more specific policies that have been introduced to manage the direct consequences of coal closures. It starts by articulating some general observations on the types of policies that have been introduced before looking at how they relate to individuals, communities, and companies.

General Observations

In the case studies we looked at, when there have been significant closures in a region over a relatively short period of time, usually as the result of a major change in policy (e.g. privatisation and industry restructuring) or fundamental change in competitiveness (e.g. shale gas), governments at local, regional, national, and supra-national levels almost always identify the need for a policy response. Unfortunately, this policy response is rarely developed prior to closures and then implemented in step with asset closures (cf. the Netherlands might be an exception).

Instead policy is usually introduced *ex post* in response to closures, sometimes with a significant time lag. Policies can be proposed as part of a package of measures that might touch on a broad range of different issues (cf. Poland and the Netherlands case studies), or be ad hoc policies that eventually add up to a package over time (cf. UK or US case study), though such packages are rarely comprehensive. The policies may or may not be joined up across different tiers of government. They may also intersect with or be interrelated with efforts undertaken by companies owning closed assets, particularly if those companies straddle multiple coal producing regions or are state-owned. Coordination between these actors is important to ensure that

Funding to help manage closures is often provided by central government and usually devolved to local government for disbursement. There is often little measurement or analysis of these expenditures to enable a suitably robust assessment of the efficacy of this support. Nor is assessment done while funds are being allocated so that lessons can be quickly learnt and applied to improve efficacy.

Because of the ex-post nature of the management of the transition, the level of policy support and attentiveness from politicians was typically correlated with the unionisation of mine workers and their relevance politically – to both local and national politics. High levels of effective worker mobilisation tend to induce greater governmental support, although it not clear whether this results in better outcomes for the areas affected over the longer term. This appears to be because, managed as they were in a reactive way, the source of the conflict tends to be reduced to symbolic questions of economic compensation distribution. However, greater compensation for workers has the potential to result in temporary boosts to current consumption that fail to address the underlying challenge of finding new employment and sources of economic activity in affected areas.

In contrast, when policies have worked to reduce the impact of coal closures they are often been longstanding commitments made over decades (cf. the Netherlands, Spanish, and UK case studies). They are also more precisely targeted and better administered. Unsurprisingly, areas have benefitted less when policies have been insufficiently long term, imprecise in terms of the individuals or communities targeted, or have been poorly administered.

'Consensual' approaches to navigating closures that actively involve workers, communities, unions, companies, and governments in a structured process have been tried in a limited number of cases (cf. the Netherlands case study). They have generally been successful, but have benefitted from a high degree of pre-agreement among different stakeholders about the need for closure.

Individuals

Many of the policies introduced to manage coal closures are concentrated on individuals, particularly mine workers and their families.

Redundancy payments, often extending to 12 or more months of full pay, have often been offered as mines close. These are usually paid to miners that have met a certain minimum period of service. They can be paid by state-owned companies; funded by governments and then paid through state and non-state owned companies; or be provided by private companies. In some cases, redundancy pay is combined with additional welfare payments and/or early pension payments.

A strong lesson in relation to redundancy payment is that they are not, by themselves, a sufficiently good tool to allow workers to transition from mining to other activities and, if given generously and at the expense of other more useful tools for workers, they can have unintended and deleterious effects on future employment prospects. In particular, there is evidence from the case studies that workers that received lower and/or shorter redundancy payments and other commitments to facilitate new work (whether through paid retraining, paid relocation, or insertion into on the job training in a new sector) systematically fared better than those that received larger monetary payments. In the Polish case study, for instance, most workers given the choice preferred to receive more generous "golden handshakes" than paid training and less money. However, the former group were found to be significantly worse off in the longer term.

There is also a clear signal from the case studies that staged management of the workforce can help to amortise the shock of the transition – if time allows. In many coal closure areas companies start by attempting to manage work force numbers through natural turnover effects (i.e. not replacing employees as they retire or leave) or internal mobility within the company. They then move to introducing early retirement and/or voluntary redundancy, followed by voluntary relocation (i.e. moving to mines where there are still jobs), repatriation of foreign workers, and then finally to compulsory redundancy. This pathway has been followed in areas where decline has taken place over many years (cf. UK and Czech Republic case studies).

However, the logic of "more intelligent management" of workforce to prepare for and during phase down can also be extended to other kinds of practices that appear to have merit and have been used in other industrial transitions. These practices can include things like ceasing to hire workers who will be at the danger age of 35 to 45 when the mine closes; hiring temporary contract workers to fulfil new roles when there is natural attrition of key roles in the company that needs to be fulfilled; within-company mobility programs to develop new skills and give exposure to different work environments prior to redundancy, transfer to new parts or subsidiaries of the company with growth expectations, company and/or state assisted "on-the-job" retraining in new companies or sectors, etc. In general, there appears to be evidence that these kinds of practices help to amortise the shock of the transition. But they require time and a manageable balance of workers and solutions within the company to be universalised. Larger companies may also have more resources to conduct elaborate worker internal mobility and on-the-job retraining programs or to reinvest and to reposition workers into new strategic activities for the company. Smaller companies or sub-contractors may however struggle to do so.

In addition to offering voluntary relocation to other mines, more general relocation packages have been offered to help miners and their families move to areas with additional economic opportunities (cf. Poland case study). These are particularly important in areas that are highly dependent on coal production and where alternative forms of employment are not a commutable distance away (cf. UK case study – Scottish and Welsh case *versus* experience in England). In general, a challenge with such policies is that workers can be subject to the double loss of both their previous professional identity and their social and employee networks. Such solutions may therefore not be suitable for all types of workers, unless the blow of losing their social network can be softened or is desired by the workers and their families.

Companies

In response to closures governments frequently have provided support to companies. This was often induced through lobbying and special pleading at local and national levels. Both state and non-state owned companies received support.

Governments typically help in several ways. One of the most common is to strengthen company balance sheets through reducing, eliminating, or transferring mine remediation and restoration liabilities that companies have built up. Governments have also helped companies reduce or transfer pension and healthcare liabilities for mine workers. These accrued obligations are often very substantial. Despite what are in principle meant to be strict rules regarding company planning and preparation for these liabilities, in practice, they are often underfunded or companies are able to legally escape these liabilities due to legal (bankruptcy) or other political-economy considerations.

Government actions to support companies by removing these liabilities can be a double-edged sword. On the one hand, they are in reality often very significant liabilities on company balance sheets and, as such, they can prevent recapitalisation and refinancing, and put at risk company solvency. On the other hand, the likelihood that governments will bail out companies post-activity liabilities is clearly an important form of moral hazard. It also effectively amounts to allowing companies to privatise their gains from natural resource extraction and socialise their losses. These experiences would tend to suggest that governments and regions have a strong strategic interest in getting ahead of events and "economic realities" and ensuring that long-term liabilities are funded. They also would appear to reinforce the argument that an anticipated and controlled transition is preferable to an abrupt and unplanned transition.

Governments have also, particularly in the case of state owned companies, attempted to recapitalise them often through privatisation followed by newly privatised companies borrowing funds and becoming highly leveraged. Arguably this stores up problems for the future as newly privatised and highly indebted companies, even if they are more competitive, still face challenging economics that still ultimately results in closure.

On the contrary, cases where companies came out the best are where they developed alternative business strategies and governments helped them to implement them. For instance, in the Dutch case study, Dutch State Mines was able to diversify into both chemicals and gas through the support of government. To be sure, this kind of "quid pro quo" may be difficult to realise in the same way in today's European economy, where state aid is a more tightly regulated phenomenon. Indeed, this issue potentially deserved further attention in the context of the overarching policy framework for just transition, since the circumstances, it could be argued, are somewhat exceptional and out of the normal bounds of what state aid rules were designed to do.

Communities and Regions

Policymakers have often also provided *short-term transition* support to communities impacted by closures in several ways. This needs to be distinguished here from forward-looking support for regional regeneration and industrial restructuring These forms of support were often direct budget transfers to local government; direct expenditure and investment by central government in affected areas; central government exempting local government from costs, tax raising, or expenditures; and shifting obligations from local government to central government.

These all have the same net effect, which is to provide a fiscal boost to local governments in areas with communities affected by closures. The choice between the different options reflects differences in the style and nature of government (e.g. decentralised or federal systems versus more centralised systems). It also reflects the presence of costly obligations locally (or not) and the requirement (or not) to secure support from local governments in policy decisions by central government.

The funds provided to communities either directly or indirectly from central governments were largely designed to help local government meet additional costs of funding subsidies to individuals (outlined in the previous sub-section). Funds are also provided for investment and these are discussed in the next section.

Investing in the Future

Across the case studies looked at in this project, there were rarely a coherent vision and strategy developed for how to replace employment and income from coal production. In some cases, such as the Limburg region in the Netherlands, and to a lesser extent in the UK and Spain, strategies were developed and implemented. These had varying degrees of success, although the evidence suggests that these efforts were broadly worthwhile. Nonetheless, it is also clear that the challenge is difficult, especially where mining is far from other centres of economic activity, or where the size of economic output and employment to be replaced is very large relative to the absorptive capacity of the economy of the surrounding region.

In areas that are very isolated and very far from other economic centres, and thus essentially "pure mining" towns, it is arguable that such strategies are less necessary, since the community is often there purely for the mining activity itself, and in todays world, are often not permanently based in the region in any case.

Similarly, in places that very large and diversified economically and very close to areas of alternative economic activity, it is arguable that such strategies may be necessary but require a different magnitude of intervention. The view has usually been that other sectors, with some support from government, are able to absorb unemployment over time (cf. UK and US case studies). There seems to be some evidence for this, although, in reality, new sources of employment often pay less than mining did, the and the influx of new unskilled labour can reduce wages in other sectors. Further, due to the lack of attractiveness of new work workers often struggle prefer to seek early retirement or incapacity benefit than re-enter the workforce, which increases dependency ratios (i.e. the number of workers to non-workers) and put stress on the regional economy.

In small local economies that are more dependent on coal, but where other economic life also exists and is anchored to the region geographically, visions and strategies for the future are much more important. A number of different policies were tried in these cases.

In the Dutch case study, perhaps the most successful example of restructuring, a number of policies were used that appeared to yield results. Firstly, the government specifically invested in providing new alternative sources of economic demand for the region, to create demand for new employees. This was done partly by moving parts of government and universities to the region. As these are sectors that governments control, and where profitability concerns are less of a direct concern, this appears to have been a way of getting around some of the challenges of encouraging private investment. It was also done by a focus on the development of new industrial value chains, in particular via approaches to industrial cluster building which sought to leverage existing economic activities and sources of comparative advantage.

Secondly, rather than focus exclusively on retraining, the Dutch governance of the transition sought, to the extent possible, to retrain workers in roles for which there was actual economic need. This was done via support for transfers to new sectors or companies that involved "on the job learning", rather than class-room based training that may or may not fit actual company needs or the evolution of employment demand.

Third, the government in the Limburg case sought to focus on education of the next generation. This was an important part of a strategy to try to avoid having the children of mining families fall into educational disadvantage that could in turn risk to perpetuate some of the economic challenges of their parents. These policies can include investment in local education institutions, financial support for access to university or other post-high school education, and infrastructure to help facilitate physical access to education.

Despite these activities, however, it needs to be acknowledged that regional economic regeneration is a challenging issue. Partly because equivalent sources of local economic comparative advantage may not exist. Partly because, even if that comparative advantage exists and can be exploited, it may not necessarily provide the kind of employment that fits with the profiles of the workers who no longer have jobs in the mining industry. Of course, higher economic activity will also create demand for other industries that may employ miners. But this can also take time, and the match may never be perfect.

Regeneration policies are often also focused on enabling infrastructure investments, particularly for transport infrastructure. Policymakers justify such investments on the basis that they can create local demand for labour, improve connectivity within affected regions and between these areas and areas that are more developed, and are supportive of a wide range of different sectors and enterprise more broadly. Some of these investments are undoubtedly productive, though others might generate poor returns and increase commuting rather the creation or expansion of local businesses. Evidence of the costs and benefits of such investments is not readily available.

Local and central governments also create tax incentives or lower regulatory burdens for businesses expanding or relocating in affected areas. Of course most businesses do not decide where to be located simply on the basis of tax incentives, particularly quite marginal ones (which is usually the case). As a result, such incentives amplify a pre-existing desire for businesses to expand or locate in an area but do not seem to generate completely new business (cf. UK case study). They may therefore be effective as part of a basket of incentives including market push and pull policies. If applied to implanted businesses, they may also help to ensure that local businesses have more revenue to reinvest in the region and remain viable. However, such policies would of course need to be temporary.

Central governments often let local governments retain tax revenues from new or growing businesses in impacted areas. The idea here is to encourage local government to foster entrepreneurship and enterprise and to make sure local government incentives are appropriately aligned with business creation and expansion.

Other regeneration investments made by different tiers of government in response to coal closures include those focused on community welfare (e.g. sports centres, town halls), cultural heritage (e.g. mining museums), education (e.g. establishing branches of universities), and promoting tourism (e.g. through advertising campaigns).

As discussed, governments often incentivise new or existing businesses in the areas impacted through tax reliefs, grants, or concessional loans. Incentives are also sometimes introduced to reward businesses for hiring laid off mine workers (cf. Poland case study). These measures can be provided by central government, local government, or even supra-national government (in the case of European Union structural adjustment funds).

Another strategy for less diversified and more remote areas can be characterised as 'managed retreat'. This is when miners and their families are encouraged to relocate to areas with greater economic opportunities. This is in recognition of the prohibitive costs of sustaining or developing new sectors in situ and the reliance on large subsidies. In today's world, these managed retreat strategies may in some cases be easier to secure public support for, since in very remote mining locations workers may actually be largely composed of contract workers with limited roots in the region anyway. However, there is little research looking at whether managed retreat strategies have worked or not or what the challenges are.

Unfortunately, from the case studies analysed in this Report, and with the possible exception of the Dutch case study, it is rare to identify productive virtuous cycles of regional regeneration after significant mine closures, where an area recovers relative to other areas of the national economy. However, this appears to be linked to the very sudden, unanticipated and involuntary nature of the transitions studied in this report. It is likely to be some combination also of the sheer scale of economic decline, the difficulty of the task, the challenges of mobilising sufficient public resources, and too little good policy design and implementation.

Conclusion and Recommendations for Further Research

This summary report takes a step back from individual country experiences of coal closures to articulate some overarching themes and provide some early conclusions that can inform future policy development and research.

Unfortunately, there is much that is unsatisfactory with how policymakers have dealt with the closure of coal production assets in the past. Policy responses are not usually developed prior to closures and then implemented in step with asset closures. Nor are coherent visions and strategies developed for how to replace employment and income from coal production.

The argument for urgent pre-emption is compelling. Historical case studies show that significant transition in the coal sector can happen surprisingly fast, and that policy that is behind the curve leads to poor outcomes. The scale and pace of coal closures required to ensure climate stabilisation increases the urgency, but even in a world without a climate imperative, technological change and other developments are likely to depress coal demand and result in significant coal closures. Every which way policymakers look, urgently and pre-emptively acting to design transition strategies away from coal makes sense.

Policymakers need to be explicit that there will be political economy frictions facing coal producing areas from NDC implementation and that these need to be proactively managed and that there is an important role for government in managing them. This is a necessary condition for acting.

Individual measures should be conceived as part of a comprehensive and consistent policy package designed according to transparent objectives. Coherent strategies should be prioritised opposed to a collection of discrete measures created on an ad hoc basis over time.

Not all areas are the same. There are significant differences in the capacity of areas to adapt. Regions that are isolated and far away from centres of economic activity will likely need different kinds of support. Prioritising areas with less capacity to adapt is also important in terms of deciding how to allocate finite public funds.

Relatedly, policymakers need to decide whether managed retreat is appropriate or not. It might be more cost effective to select a managed retreat strategy than to 'throw good money after bad' in an attempt to regenerate areas that cannot ultimately be regenerated due to the fundamentals of their economic geography. As noted above, in principle this should depend on the economic circumstances of the specific region in question. However, in practice it is important that policy makers and stakeholders do not fall for false or short-term solutions that are deceptively attractive for political reasons, but ultimately costly, provide a brief boost to local regional economies but ultimately leave them without any long-term solution.

Despite the clear relevance of this topic to the effective implementation of climate policy, this is an under researched area. Moreover, the case studies that were examined here unfortunately do not provide a comprehensive response to all of the key questions, or they raise new questions about how to arrive at specific solutions. The following non-exhaustive list of research questions, if answered, would help to better understand what works and what does not.

- **How does one convince key actors to anticipate a transition?** The case studies raise the vital importance of early acceptance and anticipation of the need to transition for success. However, they do not provide a large amount of evidence about how to promote the broad acceptance and desire to anticipate the transition, let alone how to do so in a context of climate policy. Key questions are raised: For instance: What narratives are audible to different communities in terms of legitimating the transition? How does one avoid falling into a populist trap by appearing to have

a central government or global community impose the loss of local jobs on a vulnerable community? Which strategies for gaining the trust of social partners, companies, regions that they are better off engaging in dialogue and implementing steps to transition rather than simply taking a short-termist attitude? How should these strategies be adapted depending on the circumstances and levels of economic opportunity of the region to regenerate economically?

- **How should the costs of the transition be managed?** A recurrent theme of the case studies is that investing in a well-managed, especially in terms of regional economic adjustment is required, costs money and this investment requires financing, even if it is economically rational. A number of important questions are raised here: How should transitions be financed? What is an equitable division of costs for the transition between public and private sector to pay for the transition? On what principles (and economic options) should it be based?

- **What leverage can governments or indeed other stakeholders use to ensure that stakeholders pursue strategies that are in the collective interest?** The case studies raised the issue that while key actors can have an interest in anticipating the transition, their incentives differ and may always be well aligned. In particular, there was a risk of short-termist strategies trumping the long-term collective interest. For instance, how can one convince governments to invest in protecting and preserving human capital of individuals in affected regions? How can companies be held to pay for their fair share of the costs of site remediation, and participate constructively in regional transition where appropriate? How can workers be encouraged to avoid the deceptive attractiveness of generous golden hand-shakes in exchange for retraining and work, even if that work is potentially lower paid or involves a loss of responsibility? How can local companies be encouraged to hire and retrain workers who may be, a priori, not their preferred employee profile? Etc.

- **What policies are most effective to preserve and build human capital in former mining regions?** Human capital preservation and protection, including the need to avoid intergenerational transmission of the negative economic consequences of transition, were a key result of the case studies. The case studies highlighted the importance of certain factors, such as infrastructure and education, promoting employment opportunities, avoiding long-term inactive worker status, the limits of retraining schemes and the potential advantages of on the job retraining and internal company mobility to avoiding long-term inactive worker status. However, the analysis appears to only have scratched the surface of how one tackles these risks, especially for specific sub-groups of the local population and under different circumstances (e.g. managed retreat vs. regional economic regeneration)

- **What theories of regional economic regeneration can guide decision-makers?** A key message of the case studies is that local circumstances matter for regional economic regeneration strategies. But how specifically should regeneration policies be tailored to local circumstances? What are the main variables to be taken into account and what principles are useful to follow? What specific models and practical examples exist that can help policy makers to draw inspiration? Related to this are others questions, such as: how should policies change over time? How should subsidy and support for affected areas change too and what signalling early on, particularly in terms of duration of support, is helpful or unhelpful? What do successful 'exit' strategies look like for policymakers and what are the signposts that suggest when an exit might be appropriate? Another related issue is: how to guide decision-making promote investments that have long-term potential for success, but potentially limited short-term political attractiveness, rather than short-term solutions that may have high political attractiveness, but limited long-term value?

- **What training and support for finding new employment works best under what circumstances?** What are the characteristics of successful employee reconversion schemes? How can a link between economic demand for specific skills and employee retraining be ensured? Where is on-the-job (re-)training appropriate and what are its limitations? What solutions exist to manage the psychological fall-out of workers in the "danger age" of 35-45 who face redundancy?

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COAL TRANSITIONS:
RESEARCH AND DIALOGUE ON THE FUTURE OF COAL

COAL TRANSITIONS is a large-scale research project leaded by Climate Strategies and The Institute for Sustainable Development and International Relations (IDDRI) and funded by the KR Foundation.

The project's main objective is to conduct research and policy dialogue on the issue of managing the transition within the coal sector in major coal using economies, as is required if climate change is to be successfully limited to 2°C.

THIS PROJECT BRINGS TOGETHER RESEARCHERS FROM AROUND THE GLOBE, INCLUDING AUSTRALIA, SOUTH AFRICA, GERMANY, POLAND, INDIA AND CHINA.

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