

Managing Coal Mine Closure

Achieving a Just Transition for All

November 2018



WORLD BANK GROUP

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This issues paper summarizes lessons-learned from more than two decades of World Bank assistance on coal mine closure to governments, enterprises, workers and their communities. This in-house experience was further enhanced by a review of other global experiences to produce a summary of key considerations for planning and implementing coal mine closure programs. The World Bank continues to provide assistance on coal mine closure that is underpinned by practical experience, leading-edge skills and valuable lessons-learned – necessary for a just transition for all.

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Abbreviations

AZM	Agentia Zonelor Miniere
CEO	Chief Executive Officer
CDN	Canadian dollars
CGMC	Central Group for Mine Closures
FIDIC	International Federation of Consulting Engineers
GBP	British pound sterling
GHG	greenhouse gas
ha	hectares
HSE	health, environmental, and safety
IAC	Inter-Agency Commission
IAP	Implementation Assistance Project
IAS	Industrial Adjustment Services
IEA	International Energy Agency
IGU	International Gas Union
IMCSC	Inter-Ministerial Coal Steering Committee
IRENA	International Renewable Energy Agency
LCOE	levelized-cost-of-energy
LNG	Liquefied Natural Gas
MATS	Mercury and Air Toxics Standards
MCSER	Mine Closure, Environmental and Socio-economic Regeneration
MCSM	Mine Closure and Social Mitigation
NAD	National Agency for Development
PV	photovoltaic
SEED	Social Enterprise and Economic Diversification
SECAL	Sector Adjustment Loan
SOE	state-owned enterprise
TCF	trillion cubic feet



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Executive Summary

- 1 Over the last half century, large-scale changes to coal¹ industries across Europe, and more recently in the United States and China, have resulted in as many as 4 million coal workers losing their jobs.** Drivers of these changes are found in mine mechanization, government policies and competition from other fuels in downstream energy demand markets. The impact of coal use on air and water pollution requires that these impacts are mitigated by using less polluting fuels. Shifts away from coal arise, as the cost of alternative fuels decreases and their availability increases. In different countries this shift has been caused by a variety of factors including increased use of nuclear power, increased availability of natural gas and, more recently, increased use of renewable energy. As commercial concerns impact coal use, the coal industry turns to the increased use of mechanization to remain competitive. The overall result has been closure of less efficient mines with consolidation around more efficient, lower-cost, mechanized operations. The varying influences these drivers of change may have on domestic policy responses to energy transition does not, however, deter from the inevitability of coal mine closure. In all mine closure case studies, job losses, and the subsequent socioeconomic impacts borne by families and communities in coal-dependent regions, are significant.
- 2 At present, economies in Asia, Eastern Europe, and Africa face these same drivers of change.** Large job losses are already taking place in China, with other large coal producing countries in Asia likely to follow. Lessons drawn from the experiences of the Russian Federation (Russia), Ukraine, Poland, and Romania,² complemented by data on impacts of coal industry adjustment in the United Kingdom, the Netherlands, the United States, and China, show that job losses in the coal industry are indeed inevitable as the industry contracts. Those that bear most of the burden are coal miners, their families, and communities, particularly the mono-industry communities. However, these changes also impact owners and investors in the coal industry. Each of these stakeholders can exercise considerable sociopolitical and economic impact on closure processes. The challenge comes in balancing the diverse needs of all groups.
- 3 The narrow economic base of many coal mining regions requires careful mitigation of coal mine closure impacts.** Coal mining is often concentrated in regions far from major population and economic centers where alternative employment prospects may be found. As a result, “mono-industry” coal towns and regions face multiplying and damaging impacts from mine closure. The loss of mining employment substantially reduces the flow of income through these local economies—affecting retail, food services, and other dependent sectors, as well as social services. Indeed, the loss of a local economy’s dominant economic engine exposes the fragility





of many coal mining regions’ narrow economic base. Unique characteristics of coal mining communities—such as geographic isolation, disparity of wages, and coal mining identity—pose challenges for recovery efforts. Decades later after a mine has shut down, many coal-dependent regions continue to lag socially and economically.

- 4 **Therefore, mine closure is, in large part, about mitigating impacts on people and communities.** In highlighting the central concern for people and communities, mine closure approaches which adopt “Just Transition for All”³ principles can achieve meaningful outcomes for mine-affected communities. In this report, a “Just Transition for All”⁴ for coal mine closure is underpinned by: (i) continuous dialogue and consultation with a wide variety of affected stakeholders to determine scope, scale, and timing of closure; (ii) adequate planning at the outset which is sustained through dialogue and participatory monitoring during the various stages of closure and transition; (iii) provision of temporary income support to workers and their families that is complementary to other existing social protection programs; and (iv) deployment of active labor market policies that offer services, programs, and incentives to encourage and enable re-employment among laid-off workers.⁵
- 5 **Nine lessons learned on managing coal mine closure are proposed.** They are organized around three pillars: 1) Policies and strategy development; 2) People and communities; and 3) Land and environmental remediation. The lessons are presented in Table E.1.
- 6 **Given the energy transition, planning and preparing for coal mine closure are essential to lessen the shock to coal-dependent communities and facilitate new employment possibilities for redundant workers.** A sustained commitment will be required from several stakeholders—governments, international financial institutions, the private sector, and civil society—to ensure this is achieved. Forward looking, governments can augment the findings from this report with country- and region-specific diagnoses of the drivers to reform their respective coal sectors, address their social protection needs, and mitigate environmental risks. Collaboration is also necessary to implement the support programs for laid-off workers, their families, and their communities focused on helping them get back into productive employment, with programs and initiatives that facilitate broad-based economic growth and job creation by the private sector. Strong analysis to inform decision making, together with mobilization of public and private sector financing, will be critical. Going even further, considerations regarding regional economic diversification and rejuvenation to foster job creation beyond coal mining are also of importance, but beyond the scope of this report. Calling on all those with expertise and resources will require leveraging existing, and putting in place new, platforms, partnerships, and ways of working that can catalyze action at the scales commensurate to the needs of a Just Transition for All.

Table E.1: Lessons Learned on Managing Coal Mine Closure

Pillar 1: Policies and strategy development

Emphasizes that coal mine closure requires clear policy direction, large budget outlays, and significant stakeholder consultations

Lesson 1: Managing the social and labor impacts from coal mine closures is best achieved when multiple agencies participate in the policy development.

Lesson 2: Meeting the substantial budget needs for mine closure is a challenge given the short-term, high costs required.

Lesson 3: Genuine stakeholder consultation starting at the planning stage and continuing throughout the closure process can significantly reduce the possibility of social conflicts.

Pillar 2: People and communities

Underlines the importance of a Just Transition for All to meet the needs of workers, families, and the wider community

Lesson 4: A systematic process to mitigate social and labor impacts that starts before any labor layoffs occur can result in a more orderly, less stressful, and ultimately lower cost divestiture process.

Lesson 5: Pre-layoff planning and assistance can prepare workers for impending layoffs.

Lesson 6: Post-layoff assistance, including temporary income support, can help sustain laid-off workers in a way that results in them staying in the labor market.

Lesson 7: Active labor market policies offer services, programs, and incentives that can encourage and enable re-employment among laid-off workers.

Pillar 3: Land and environmental remediation

Advances the importance of financial planning for environmental remediation and land reclamation, and summarizes a range of possible financial assurance mechanisms available

Lesson 8: Environmental reclamation is best addressed from the outset of mine planning.

Lesson 9: Financial assurance mechanisms can be an effective tool to guarantee funding availability.





Introduction

OBJECTIVES

- 7 **Over the last half century, large-scale changes to coal⁶ industries across Europe, and more recently in the United States and China, have resulted in as many as 4 million coal workers losing their jobs.** The main drivers of these changes are mine mechanization, government policies and competition from other fuels in downstream energy demand markets. At present, economies in Asia, Eastern Europe, and Africa face these same drivers of change, with large job losses already taking place in China, and with other large coal producing countries in Asia likely to follow. Lessons drawn from the experiences of the Russian Federation (Russia), Ukraine, Poland, and Romania from 1994 to 2012,⁷ complemented by data on impacts of coal industry adjustment in the United Kingdom, the Netherlands, the United States, and China, show that job losses not only take place as the industry contracts but even if production is increasing. The mitigation of social conflict and economic distress are of grave concern as globally the coal industry enters a new era of downsizing.
- 8 **The objective of this report is to share with governments lessons learned regarding coal mine closure.** Indeed, the full set of coal mine closure issues is diverse with few positive case studies to date to draw on. The complexity of technical issues and vested interests along with the myriad of potential risks which may unfold will require combining time-tested and new approaches, and applying a broad array of skills. In this issues paper, we have sought to identify lessons from the past that can guide policy makers for more successful future mine closures. Nine lessons learned are presented for government consideration, drawn from three sets of literature. First, analysis from coal industry adjustment and downsizing experiences in Russia, Ukraine, Poland, and Romania from 1994 to 2012⁸ where interventions ranged from preparatory diagnostic and technical studies to planning and financing of eventual closure programs. Second, observations and insights on impacts from coal industry adjustment in the United Kingdom, the Netherlands, the United States, and China.⁹ Third, evidence-based interventions that have helped to mitigate potential negative social and labor impacts from mass job losses in other industries.
- 9 **The report consists of three sections.** First, the Drivers section discusses the three key drivers to coal mine closure and provides relevant examples on the interactions amongst specific drivers and their outcomes on coal closure programs. Second, the Key Lessons section captures learning from past World Bank





projects and global evidence from impact evaluations on social protection and labor programs outside the coal sector. The third section provides the conclusion of the report and underscores the importance of planning and preparedness starting now.

THE IMPORTANCE OF A JUST TRANSITION FOR ALL

- 10 **Asia is likely to be most impacted by future coal mine closures, as global coal production has pivoted from West to East.** Consider that in 1960 the largest coal producers in western Europe were the United Kingdom, the German Federal Republic, and France, which collectively produced 394 million tons of coal, equivalent to 20 percent of global coal production. By 2016 their collective production had dropped to less than 10 million tons hard coal,¹⁰ a decrease by 97 percent over the past five decades. In the United States, the production decrease has been more recent. As shown in Table 1, since 2000, production in the United States declined by 369 million tons, leading to a drop in its global market share from 21 percent to 8 percent. In contrast, China more than doubled its production since 2000 and now accounts for 44 percent of total global coal production. India and Indonesia also experienced a major rise, and they now account for 10 percent and 6 percent of global production, respectively. In 2016, these three countries made up 60 percent (about 4.4 billion tons) of total global production. As shown in Table 1, Russia, South Africa, and Poland are also in the top ten for coal production globally. In fact, these countries (alongside China, Indonesia, India, and Australia) will most likely be impacted most acutely by future mine closures.

Table 1: World hard coal and lignite production (million tons), 2000–2016¹¹

Country	Production Change 2000–16	Production 2000	Global Share 2000 (%)	Production 2016	Global Share 2016 (%)
China	1,833	1,377	30%	3,210	44%
India	372	336	7%	708	10%
Indonesia	380	79	2%	459	6%
Australia	202	307	7%	509	7%
Russia	97	242	5%	359	5%
South Africa	26	224	5%	250	3%
United States	-369	972	21%	683	8%
Poland	-32	163	3%	131	2%
Germany	-28	205	4%	177	2%
Others	135	718	17%	802	12%
Total	2,636	4,623	100%	7,288	100%

Source: Enerdata 2017. *Global Annual Statistical Yearbook 2017* available at bit.ly/2Jsynyx



- 11 **The narrow economic base of many coal mining regions requires careful mitigation of coal mine closure impacts.** Coal mining is often concentrated in regions far from major population and economic centers where alternative employment prospects may be found. As a result, “mono-industry” coal towns and regions face multiplying and damaging impacts from mine closure. The loss of mining employment substantially reduces the flow of income through these local economies, affecting retail, food services, and other dependent sectors, as well as social services. Indeed, the loss of a local economy’s dominant economic engine exposes the fragility of many coal mining regions’ narrow economic base. Box 1 summarizes key characteristics of coal mining communities which pose challenges for recovery efforts. Decades later after a mine has shut down, many coal-dependent regions continue to lag socially and economically. Planning and preparing for coal mine closure are essential to lessen the shock to coal-dependent communities and facilitate new employment possibilities for redundant workers
- 12 **There is a political economy consideration around coal mine closure given the stature of coal miners.** Coal workers have had a unique identity and high social standing in many countries. Much of their work takes place in dangerous underground conditions where mistakes can cost lives, and coal miners have previously expressed themselves strongly in the political economy around mine closure. For example, in the United Kingdom coal workers went on strike for a year to oppose mine closures, and in Poland workers marched on the Parliament.

TEXT BOX 1

Typical characteristics of coal mining communities that influence the potential for regional recovery

Narrow economic base of a coal-dependent region exposes the fragility of the economy, in terms of job creation potential.

Geographic isolation of most coal mines means that the loss of the main regional employer dramatically reduces overall re-employment potential.

Disparity of wages between coal mining and alternative professions is often cited as a stumbling block to re-employing former coal miners.

Coal mine identity centers on strength, determination, hard work, and risk. Shedding this identity can be one of the biggest stumbling blocks to re-employment.

Indirect job losses from subsidiary businesses accentuates the social and labor challenge; indirectly affected individuals may be more at risk if not considered as beneficiaries of temporary income support or active labor market policies.



Furthermore, coal miners can have a very strong identity with their community—with successive generations of workers working in the coal mines, which can result in very close-knit communities so that redundant workers may be reluctant to relocate their families to find work in other locations.

- 13 **While job losses from coal mining may be small in comparison to the total labor force, a downsizing can result in a disproportionately high impact locally.** The coal industry numbers are usually small relative to the total population. By way of example, in the United States, in 2017, direct coal mining jobs nationwide stood at 49,650 jobs¹² with an additional 34,170 jobs in coal plant operations.¹³ Together, these two segments of the coal industry represent only 0.06 percent of the United States' workforce. Or consider China where less than 3 million workers who are registered as coal miners are less than 0.4 percent of the national workforce of 770 million. Yet due to the characteristics described in Box 1, impacts from coal mine closure are significant with disruption of regional and local economies inevitable.
- 14 **The potential for economic and social shocks due to coal mine closure underscores the importance of strategic planning.** In the coal sector, rarely have closures been supported by successful social mitigation strategies. In fact, governments have typically struggled to support the people who lost their jobs and their families, and the distressed communities. Distress is particularly acute as closures also affect industries across the coal value chain, especially in businesses providing goods and services to the coal economy. Layoffs can have dramatic and long-lasting effects on the employment, earnings, and income prospects of directly displaced workers and their families. Research from the United States and other countries shows that many of these workers may have long unemployment spells and that those who find work may suffer earnings reductions of up to 30 percent over at least 15 to 20 years.¹⁴
- 15 **Therefore, coal mine closure is, in large part, about mitigating impacts on people and communities.** In highlighting the central concern for people and communities, mine closure approaches which adopt “Just Transition for All”¹⁵ principles can achieve meaningful outcomes for mine-affected communities. In this report, a “Just Transition for All”¹⁶ for coal mine closure is underpinned by: (i) continuous dialogue and consultation with a wide variety of affected stakeholders to determine scope, scale, and timing of closure; (ii) adequate planning at the outset which is sustained through dialogue and participatory monitoring during the various stages of closure and transition; (iii) provision of temporary income support to workers and their families in complementarity to other existing social protection programs; and (iv) deployment of active labor market policies that offer services, programs, and incentives to encourage and enable

re-employment among laid-off workers.¹⁷ The Government of Alberta has announced a commitment to end coal fired power generation by 2030, supported by a commitment that includes an allocation of Canadian dollars (CDN) 45 million to support a “just transition” for coal workers and their communities. It is reported that the phasing out of coal fired power generation has gained the support of organized labor.¹⁸

- 16 **There are few if any instances of fully satisfactory economic rejuvenation outcomes in mono-industry coal mining towns.** While economic diversification and rejuvenation is a topic shared across many industries, as discussed in Pillar 2 (below), for coal mine closure the loss of the main regional employer dramatically reduces overall re-employment potential and exposes the fragility of a narrow economic base. The compounding effect is significant and the rejuvenation of local economies in coal-dependent regions is a complex challenge and can fail even if good intentions and sufficient funds are deployed. For instance, the United Kingdom long targeted various forms of regional aid with the intention to foster job creation at several of its main mining areas, including through a program of coalfield site reclamation and redevelopment that disbursed more than British pound sterling (GBP) 600 million between 1996 and 2007. In addition, British coal mining regions have been supported by the European Union, both through disbursement of its “standard” structural funds and specific programs like the RECHAR program that deployed more than GBP 250 million over 10 years. Still, decades after the major waves of mine closures in the United Kingdom, labor market impacts can still be felt—especially where difficulties are entrenched, such as South Wales. Therefore, mobility support for workers to relocate out of mono-industry coal mining towns may sometimes represent the better option.¹⁹





Drivers of Change: Their Relationship to Coal Mine Closure

- 17 **Closures create disruptions whose social and labor impacts, if anticipated, may be more effectively mitigated.** In most of the countries reviewed for this report, closures create rapid disruption of the coal mining sector, catching governments, companies, coal workers, and communities unprepared to address the sudden shock. Based on these cases, it is observed that if a country has a large population of coal workers, especially in labor-intensive and inefficient mines, then labor divestitures in the coal industry will suddenly unleash vast numbers of people onto social protection services, straining and possibly overwhelming the system. Take for instance Russia, Ukraine, Poland, and Romania where employment losses were close to 2 million over a decade, declining from around 2.7 million workers in 1990 to less than 1 million in 2001.²⁰ More recently, coal industry employment in China has declined by over 2 million workers from over 5 million coal workers in 2013 to less than 3 million workers in 2018.²¹ Through a good understanding of the drivers and their impacts, governments are in a better position to anticipate how closures may unfold. See Figure 1.

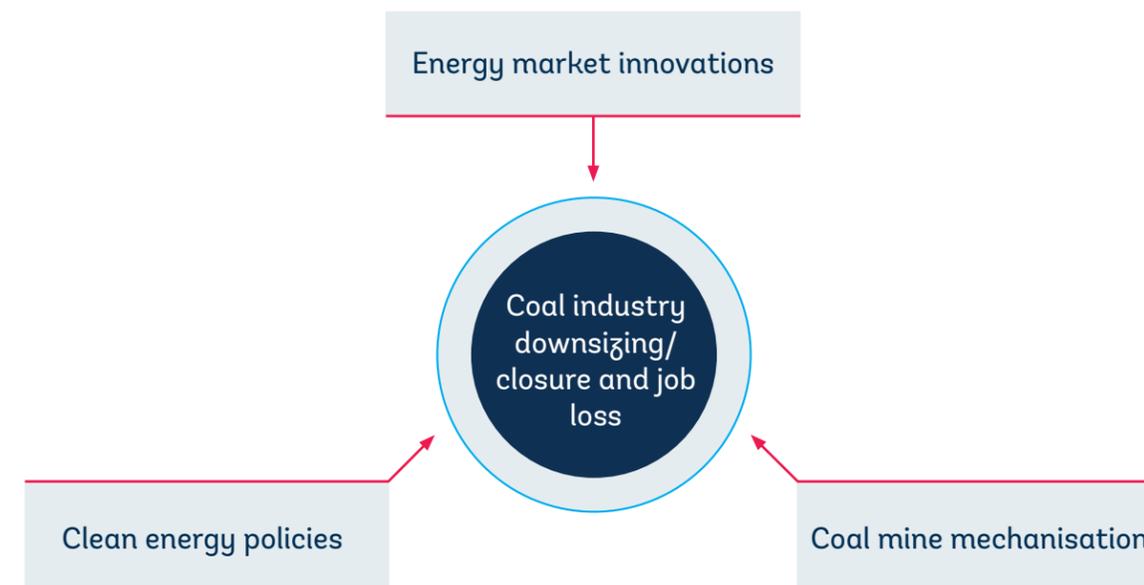


Figure 1: Drivers of Change





- 18 **The first driver of change is mine mechanization.** Technical improvements in coal extraction methods and technologies continue to be introduced in response to macroeconomic and business pressures. The effect is a consolidation of operations by shifting production from less efficient and unmechanized mines to more efficient mechanized operations. The end result is a net loss of jobs. Practically, as seen in the United States and Russia over the past four decades, the coal industry first sheds the least efficient operations and then consolidates around the remaining technology intensive operations. Mechanization induces coal mines to shed labor, which helps create greater financial resilience by increasing productivity. Even under the International Energy Agency's (IEA) business-as-usual forecast scenario,²² which predicts global coal production to remain relatively constant at current levels to 2040, countries will face strong disruptions on the regional level as less efficient coal mines close under continued industry consolidation. In the affected regions, this will lead to significant losses in coal sector employment. In this situation, job losses will be significant locally/regionally, but may be less visible when viewed across the total labor pool nationally.
- 19 **The second driver of change is clean energy policies.** This includes local and regional air pollution prevention programs, low carbon and clean energy development agendas, and worker and community safety initiatives. In general, progressive government policy interventions in favor of alternative energy sources over the last fifty years have included: (i) policies to reduce rampant air pollution—e.g., Western Europe in the 1960s and today in South and East Asia and Poland; and (ii) more recently policies and programs that address climate change, including an energy transition favoring lower carbon/zero carbon energy resources, away from coal. The global movement to reduce greenhouse gas (GHG) emissions has moderated overall energy demand (especially coal) and shifted energy use to more flexible energy sources with lower or no carbon emissions.
- 20 **The third driver of change is the changing dynamics of the energy sector affecting coal consumption.** This has two aspects. First is a slowing of demand largely resulting from energy efficiency improvements. Unlike past decelerations of energy demand that were driven by broad economic slowdowns, this decrease has been driven by energy efficiency measures, enabling a decrease in global energy intensity²³ by 2.8 percent in 2015 and 2.0 percent in 2016. Governments' energy efficiency policies and regulations have supported this transition through standards, building codes, public financing, and tradable energy certificates. As a result, there has been a strong increase in the uptake of energy efficiency investments like LED lighting and energy efficient heating and cooling.²⁴ Alongside demand, the second aspect is a broad shift in energy

supply/use with decreased costs and increased availability of alternative fuels, such as renewable energy and gas. From 2014–2015 global energy production grew by 0.3 percent with non-OECD countries energy production growing by 0.5 percent and OECD countries declining 0.3 percent²⁵ much lower than 2 percent as was typical in the past.

- 21 **Under this third driver, the commercial viability of coal-fired power plants, an important industrial anchor in the coal value chain, is being seriously challenged.** Since the early 2000s, the penetration of renewable energy and natural gas has continued market loss for coal, principally in the power sector. Natural gas prices are decreasing²⁶ and natural gas trade is increasing²⁷ driven by shale gas and associated gas from oil production from tight fields. Increased market penetration of renewables within the power sector has been driven by decreases in the Levelized Cost of Electricity (LCOE), as estimated by Lazard, for utility scale solar photovoltaic (PV) (73 percent) and onshore wind power (25 percent)²⁸ over the past decade. The shale gas experience in the United States has caused a large decrease in natural gas prices²⁹, radically reducing the commercial viability of coal-fired power.³⁰ In 2011, onshore wind power became cheaper than coal, followed by solar power in 2014. Both wind and solar power are estimated to cost less than half that of coal-fired power plants.
- 22 **Drivers of change impart varying influences on both the pace of closure, and the magnitude of the impacts.** While the data do not permit analysis that would disaggregate the decline of employment in the coal sector according to various drivers, there are some prevalent patterns. Coal mine mechanization has been a long-standing persistent driver, the product of competitive market pressures from alternative fuels that have taken coal's market share. This pressure results in mechanization to improve operational efficiency and lessen cost, which in turn induces mines to shed jobs. While some state enterprises undergoing mechanization retain excess labor to the point of financial strain and then shed jobs suddenly, generally, when mechanization is the driver job losses happen relatively gradually over the decades. In comparison, policy and energy market drivers have been more discrete events in time, having more immediate impact when introduced. Moreover, policy and energy market drivers may be linked should a government introduce a policy driver to address air pollution, which in turn increases the cost of coal use relative to alternatives and thereby alters the dynamics of energy markets.





23 **The United Kingdom, Russia, and the United States are countries that show strikingly different production outcomes from the drivers.** Coal mining employment has declined substantially in all three countries. But production has followed distinctly different pathways, as will be presented in Figures 2, 3, and 4. For the United Kingdom, the initial driver of change was clean energy policies as government sought to abate severe air pollution as smog from coal use grew worse in major cities. Government then shifted to cleaner energy imports, as competitive pricing and availability of oil imports from the Middle East and Africa, and later gas from the North Sea, increased alternative energy supplies. Figure 2 shows the subsequent decline in coal production and coal employment from 1960 to 2015. The least-efficient, most labor-intensive mines were closed first, and in the 1960s employment fell by 52 percent compared with only a 26 percent decline in coal production. In 2016, United Kingdom, coal production declined to just 4 million tons with approximately 1,000 employees. The United Kingdom is expected to phase out both coal production and coal-fired power generation over the next decade, and in 2018 began to report 24-hour periods without coal-fired power being dispatched.

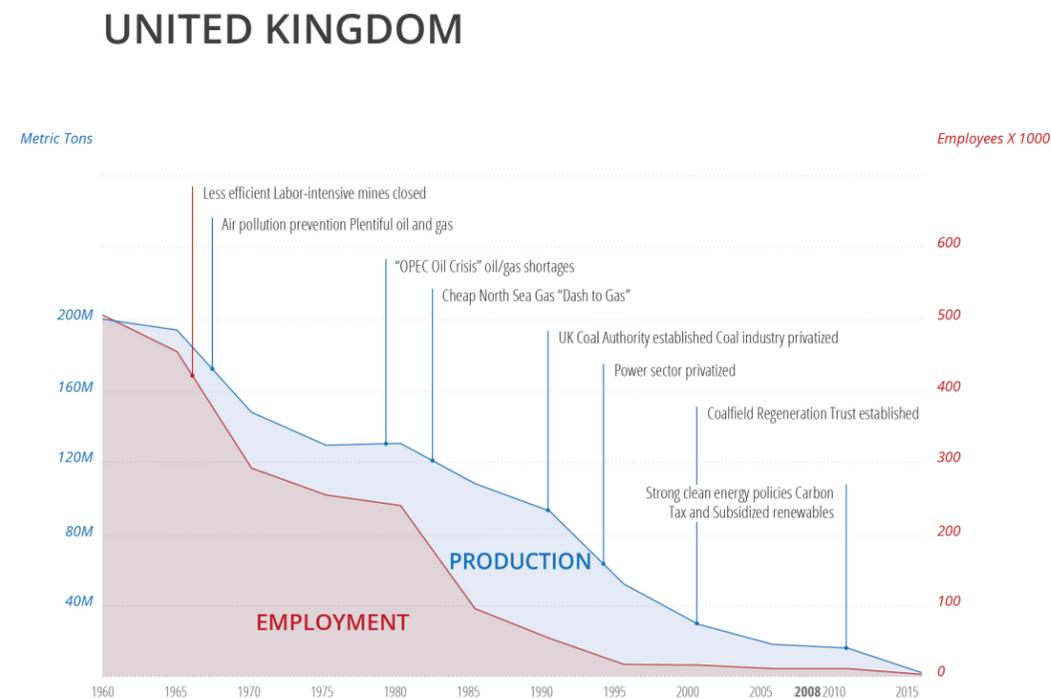


Figure 2: United Kingdom: coal production and employment 1960–2015

Source: Authors' own, based on data compiled from *Coal Transition in the United Kingdom*, Steve Fothergill (Paris: IDDRI and Climate Strategies, 2017).



24 **In the late 1980s and early 1990s, Russia was driven to adjust its coal sector as part of wider macroeconomic reforms.** As the economy contracted, coal demand declined and the government initially tried to prop up its coal industry with very large subsidies to cover losses, rather than closing mines, undertaking orderly layoffs, and reducing losses. However, the coal subsidies became unmanageable and reached over 1 percent of GDP in the early 1990s. From 1990–1998, coal production declined by just over 40 percent and employment declined by nearly 60 percent (Figure 3). Russia privatized its coal industry from 1999–2001 as part of an overall large-scale privatization policy. Industry with the lowest cost mines could stabilize—largely through mechanization—and operate profitably. The overall impact was a substantial recovery in coal production since 2000: with well over 350 million tons of production in 2016. Even as production increased, the sector continued to shed labor.

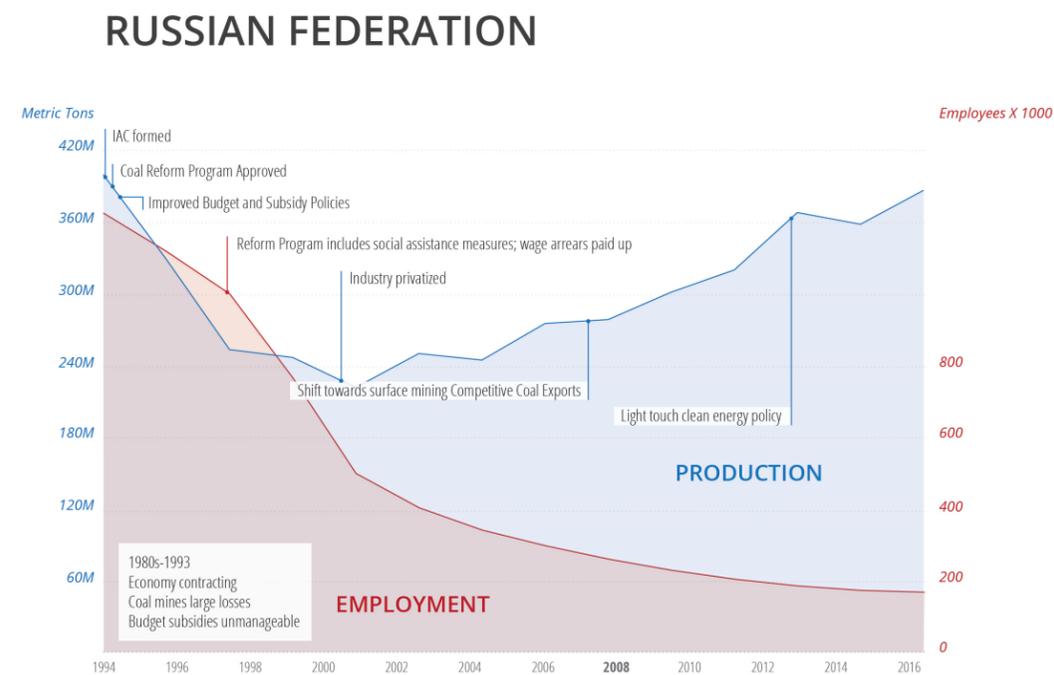


Figure 3: Russian Federation: coal production and employment 1990–2016

Source: Authors' own compiled from World Bank Reports; Russian Federation, Ministry of Energy; Mineral Survey: Russia, United States Geological Survey (USGS), various years; and from mining.com – see bibliography for full details



25 **The United States has followed a third pathway as it responds to drivers of change.** The two main drivers of change in past decades (until about 2008) were, first, economic growth, which led to steady growth in power demand for coal, and second, mechanization (including strong growth in surface mining in the western states), which led to greatly increased productivity and declining employment since the 1980s (Figure 4), especially in Appalachia. Clean air mandates have led to new emissions standards in the 1990s, which further disadvantaged higher sulfur eastern coal production as compared with lower sulphur western coal production. Coal jobs also suffered a steep decline during this period. However, after several decades of steady growth coal production and consumption have dropped sharply from 2006 to 2015 because of competition from shale gas and renewables. Coal’s share of power generation decreased from 40 percent to 33 percent, while gas-fired power generation increased from 22 percent to 34 percent, and electricity generated by renewables increased from 8 percent to 15 percent over this period. Coal power plants also responded to stronger air pollution emissions controls, including the need to meet the 2011 Mercury and Air Toxics Standards (MATS) for power plants. While the coal industry shed more jobs during this period, the job losses were modest compared to the 1980–2000 period.

UNITED STATES

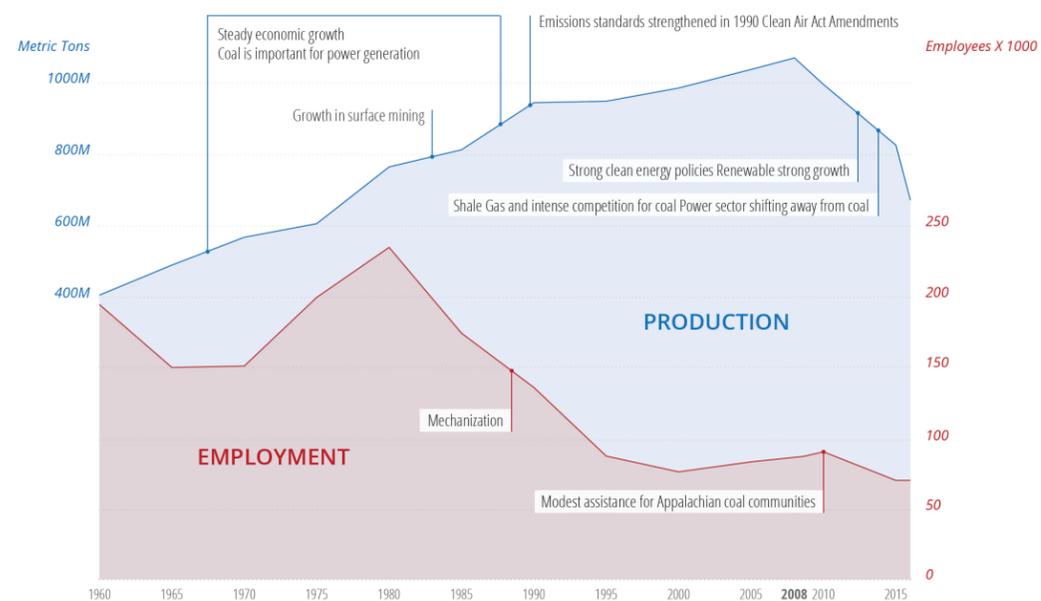


Figure 4: United States: coal production and employment 1960–2015

Source: Authors’ own compiled from US Energy Information Agency sources and from *Coal Transition in the United States*, Irem Kok, (IDDRI and Climate Strategies, 2017) (see bibliography for full details).



26 **In each case, the scale of social distress was vastly different.** The U.K. minimized social distress at the outset as miners took pensions or transferred to other operating mines. But social conflict increased over time as more mines closed. Labor strikes were a defining feature of the period from the early 1970s until the mid-1980s. Such social unrest culminated in the year-long national coal strike from 1984–85, and widely publicized opposition to coal mine closure created broader solidarity with organized labor and youth movements, leading to a complex political economy for successive British governments seeking to implement reforms. Russia experienced very severe initial distress as hundreds of thousands of miners left the industry in the early 1990s with large wage arrears and no severance packages or income support. Only as the crisis deepened did government design and implement a sector reform program which included allocating resources for a social protection response in the form of paying wage arrears and making severance payments. In the United States social distress steadily built up since the 1980s and has only been given strong attention during the past decade. Even so, there is considerable poverty in coal producing regions, especially Appalachia.



Lessons Learned

- 27 **Nine lessons for managing coal mine closure are discussed.** Lessons are organized around three pillars: i) Policies and strategy development; ii) People and communities; and iii) Land and environmental remediation. Figure 5 summarizes these pillars.

Pillars to Coal Mine Closure

Policies and strategy development

Includes the political, strategic, institutional, regulatory, fiscal/budget planning – setting in place the conditions, rules, and capacity needs and responsibilities to implement the coal sector downsizing. It also includes stakeholder engagement for workers, communities and companies, which is necessary to reduce opposition to industry downsizing, to the extent possible. Encapsulates the coal sector and other segments of the energy industry – involving industry structure, reorganization and restructuring, possible privatization of state mining companies, consolidation, financial capacities (including pensions), and exit or bankruptcy; it also addresses energy system infrastructure development.

People and Communities

Incorporates income support instruments and labor market programs to address the needs of redundant workers; it also pertains to community support initiatives and new job creation programs (reflecting different levels of resilience to sector downsizing); and impacts on workers in related and dependent industries that may use or transport coal and provide goods and services to the coal mines and miners.

Land and environmental Remediation

Covers physical mine closure and environmental reclamation and rehabilitation (including the removal of mine equipment), transfer of useful assets to the local community, securing the stability of remaining dumps and impoundments, water management and surface stability at closed underground mines, monitoring and managing any post closure environmental and human health impacts, including any legacy issues.

Figure 5: Pillars to managing coal mine closure





PILLAR 1: POLICIES AND STRATEGY DEVELOPMENT

28 **Large-scale coal mine closures require clear policy direction supported by a long-term Just Transition for All program.** Minimizing social distress is key to achieving a successful coal mine closure. Success relies on several factors: strong government commitment, legal and regulatory review, genuine stakeholder engagement, and adequate budgets for necessary social and labor interventions and for coal mine closure and environmental reclamation. The literature review for the countries that received World Bank loans concluded that the impacts of coal mine closure were more effectively and efficiently addressed when countries adopted comprehensive reform programs. While each country developed their closure programs at different stages of coal industry decline, lessons across the board demonstrate the utility in comprehensive policy planning. By contrast, other major coal producing countries did not have coal industry reform programs. Considerable conflict and miners' strikes experiences in these other countries may be attributable, in part, to an ineffective dialogue with labor groups, for instance in the United Kingdom.

Lesson 1: Managing the social and labor impacts from coal mine closures are best achieved when multiple agencies participate in the policy development.

- 29 **Government leadership is indispensable regardless of the coal industry's operating model.** Coal mine closures come at an enormous cost. How this cost is distributed will depend on the operating model: whether the coal sector is state owned and operated or privately owned and operated. State-owned models typically present greater difficulties to closure, given liabilities and social obligations. Typically, these closures require government policy and budgetary interventions; particularly as even in the absence of explicit guarantees, government will most likely bear the costs of physical closure alongside labor transition programs. Private sector closures may benefit from advanced budgetary outlays to bear some of the immediate pre- and post-layoff interventions, such as paying for statutory severance payments. In the United States, for instance, only 21 percent of coal miners belong to a union, with the remaining 79 percent working primarily as independent contractors (United States Energy Information Administration, 2017). Private sector companies undertaking coal mine closures may also prepare financially for environmental remediation and land reclamation. Constant throughout, however, will be the role of government to set policy direction and provide immediately needed measures when necessary.
- 30 **Coordination of policy development benefits from a high-level decision-making body.** Regulatory reform affecting coal use and impacts on labor involves several sector agencies. Therefore, well-managed coal mine closures would

benefit from coordination across various decision-making bodies. A high-level government body is important for decision-making processes and for clarifying roles and responsibilities across a diverse set of agencies at the national, regional, and local levels. Reforms to individual country policies and laws could include: mine closure procedures and related health, environmental, and safety (HSE) standards; energy use;³¹ environmental mitigation; land reclamation; economic revitalization; and social protection and labor transition programs. Two good examples are the Inter-Agency Commission for Socio-Economic Problems of Coal-Producing Regions (IAC) in Russia and the Inter-Ministerial Coal Steering Committee (IMCSC) in Poland. Each were instrumental in coordinating policy decision making and facilitating interministerial cooperation required for reform implementation. Apart from planning, coordination could extend to mobilizing various layers of government interventions during the actual implementation phase. The literature reviewed suggests that any high-level body is best then supported by two key agencies: one for coal mine closure and one for social protection and labor programs.

- 31 **Decision making spans different levels of government.** As shown in Table 2 government assumes several roles and responsibilities within various ministries and between various levels of government when planning for coal mine closure. Beyond policy making, roles include (i) a high-level decision-making body, (ii) institutional leaders such as ministers, agency heads, and presidents of state-owned companies; and (iii) managers and professional staff of government ministries and agencies and state-owned companies. Broadly speaking, commitment starts with the political leadership, and then is adopted and executed by the institutional leadership, managers, and professional staff. Coordination takes place largely at the institutional leadership level, which is where budgets are allocated and coordination between different ministries and agencies is established, overlaps are resolved, and gaps are filled. There may also be a division of roles between national and subnational agencies, especially given a need for community-driven approaches to ensure that communities provide input on key decisions contributing to sound expectations at the local level.





Phase 1: Policy and Programs Development
<p>High Level Decision Making Body</p> <ul style="list-style-type: none"> Provides political commitment Initiates and approves program, including budget Establishes decision-making processes Enacts any new legislation Engages with key stakeholders in the closure process Approves state-owned enterprise (SOE) reforms, including decisions on repurposing ancillary assets
<p>Institutional Leadership</p> <ul style="list-style-type: none"> Develops program Establishes new implementing institutions (if needed) Determines budget allocations between ministries and agencies. Oversees drafting of laws Approves regulations Engages with key stakeholders Proposes SOE reform programs
<p>Managers and Professional Staff in Institutions and SOEs</p> <ul style="list-style-type: none"> Prepares regulations Enforces laws and regulations Acts as key communication channel with stakeholders for program consultations
Phase 2: Implementation
<p>High Level Decision Making Body</p> <ul style="list-style-type: none"> Reviews implementation on a regular basis Approves any revisions to program and budget Reports to a high-level decision-making body
<p>Institutional Leadership</p> <ul style="list-style-type: none"> Directs specific implementation streams on physical closure and social protection and labor Engages regularly with stakeholders to assess progress Reviews any budgetary and program revisions made by professional staff
<p>Managers and Professional Staff in Institutions and SOEs</p> <ul style="list-style-type: none"> Implements program Enforces laws, regulations and HSE standards Manages physical closure and social and labor work plans Hosts regular stakeholder consultations to review progress

Table 2: Phases for managing coal mine closure: government roles and responsibilities

- 32 **Setting up a specific mine closure agency can streamline the physical closure component.** Physical mine closure and the subsequent land reclamation involves multiple ministries. Yet the control and allocation of restored coal mining lands for new uses are likely the responsibility of local authorities. Furthermore, coal mines may be state owned. Therefore, depending on the scale of closures and complexity of crosscutting responsibilities, an agency may be best placed to manage closure on behalf of several government stakeholders. Such a coal mine closure agency would take control of and physically close mines, once production has ceased. In the cases of Ukraine, Poland, and Romania, dedicated coal mine closure companies effectively managed the efficient physical closure of mines. Post-closure monitoring and maintenance may also best be undertaken by one or more separate purpose-established institutions or companies; the United Kingdom Coal Authority is a good example in this regard. By contrast, Russia did not have a mine closure agency, and eventual physical mine closure and environmental reclamation were less organized and effective.
- 33 **Concurrently, the institution with the biggest stake in the success of the labor divestiture process should lead the planning for the social and labor transition.** As with physical mine closure, social and labor transitions engage multiple ministries. A suite of social and labor transition programs may be required: provision of income support, social service delivery to the most vulnerable (women, children, elderly, etc.), active labor market policies for redundant workers, retraining, and even broader regional economic revitalization plans. Each type of intervention typically falls under separate government departments and line ministries. Appointing one institution to coordinate the stakeholder engagement and planning process can maximize synergies and ensure consistent communication with the public and stakeholders potentially affected in the coal mining areas. Such an institution would also work alongside nongovernmental organizations and coal mining companies in their responses. In Romania, for instance, the National Agency for Development and Implementation of the Programs for Reconstruction of the Mining Regions (NAD)³² was established to oversee and implement the social and labor mitigation and local development aspects of the coal sector reform programs.
- 34 **Regulations affecting labor divestiture in the coal sector significantly influence success.** Implementing labor divestiture can be affected by legal and financial restrictions, such as: national legislation, sector-specific tripartite collective agreements, and enterprise-specific agreements. All three types may need to be addressed in parallel or sequentially. With respect to implementing coal industry reform, it is important to identify key regulations that serve as obstacles to the labor divestiture process, both in terms of the *de jure* rules and its *de facto* implementation. There are examples of labor regulations which can be





formidable obstacles for labor divestiture, thus impeding reforms to the coal industry. For example, the complicated priority order for dismissals in the former Yugoslav Republic of Macedonia became an obstacle for implementing labor terminations in other sectors in the 1990s. Policy makers may need to explore options to change labor divestiture laws and regulations or create additional, more flexible regulations, if they impede reforms to the coal industry.

- 35 **Efficient administration of income support programs and active labor market policies are critical to their success.** The availability of, and interactions with, existing social safety nets set the conditions for deploying supplemental social protection and labor programs. At minimum the same amount and type of income support should be offered to laid-off coal sector workers and workers losing their jobs because of mass redundancies in other sectors. In addition to that, delivery systems—such as those related to outreach, intake, payments, contracting, monitoring and evaluation, grievance redress, etc.—should also be the same as those for existing income support measures; this will increase operational efficiencies. However, in some cases implementing agencies might in fact be different or different types of income support may be provided in parallel, potentially with different criteria due to the clientele (i.e., average training duration for coal sector workers may be longer if they need more reskilling than workers in other sectors).

Lesson 2: Meeting the substantial budget needs for mine closure is a challenge given the short-term, high costs required.

- 36 **Coal mine closure requires enormous budget outlays, often in a relatively short period of time.** The biggest line item is usually the income support packages put in place for coal sector workers (see Pillar 2). Other line items may include expenses from regulatory reforms (including restructuring of state enterprises and their liabilities); social service delivery; active labor market programs; environmental remediation and land reclamation; and overall monitoring, coordination, and reporting functions for the government institutions involved. Where there are also social assets owned, budget support may potentially be needed for the asset transfer from coal companies or state-owned companies toward local government or other parties. Budget coordination and allocations are typically done by the Ministry of Finance or Ministry of Planning.
- 37 **Some case studies illustrate the magnitude of costs.** Government budgets can run into the billions of United States dollars (USD)—with social and labor support costs being as much as three to four times physical mine closure costs. The Miners Social Packages, seen as very successful in Poland, cost over USD 2 billion for about 80,000 workers. Total costs in the Netherlands were nearly USD 6 billion (in 1980 terms) and the cost of facilitating the creation of 17,100 new lasting

jobs was estimated to be in the range of USD 450,000–600,000 per job (Gales and Hölsgens, 2017). Additional budget needs included land-related costs, such as physical closure, environmental remediation, post-closure monitoring, and maintenance costs. There may also be other very substantial stranded assets such as coal-fired power plants that are no longer economically and financially viable which fall into government ownership.

- 38 **State-owned mining companies often retain labor to the point of crisis, forcing government to absorb financial losses rather than close out mines rapidly.** This can result in losses steadily building to a point where mines are abruptly closed and the companies unexpectedly lay off large numbers of workers because the government will no longer continue providing large subsidies. When this happens, the size of mine closures and social and labor costs will be higher and much more compressed in time than if reform had started earlier. Evidence from past programs in several countries shows that government may also be forced to take over other liabilities of bankrupt private sector companies such as pensions and private retirement plans, or physical closure liabilities.

Lesson 3: Genuine stakeholder consultation starting at the planning stage and continuing throughout the mine closure process can significantly reduce the possibility of social conflicts.

- 39 **Avoidance of conflict and social unrest is a critical measure of success in coal mine closure programs.** Stakeholder dialogue and citizen engagement provide meaningful mechanisms for addressing concerns of the coal industry workers and other members of coal mining communities at all societal levels. Formal engagement mechanisms provide the vehicle by which constituencies can comment and contribute to closure and economic recovery planning. Therefore, it is indispensable to engage early in the planning process with potentially affected stakeholders. Early in the planning phase, information campaigns can reduce misinformation circulating in potentially affected communities. Campaigns cover topics such as: (i) the intent to plan social and labor support alongside coal mine closure; (ii) the stakeholder engagement strategy; and (iii) the general nature of the planned assistance for displaced workers. Correct information is critical to avoiding social conflict and therefore should be handled by the entities designing and implementing the social and labor programs themselves. Above all, care should be taken not to advertise services that cannot be delivered, as this will add to, and not reduce, social tensions. A diverse stakeholder group should be expected across: industry workers and their unions, managers of state-owned coal companies, nonprofit groups already providing services in local coal mining areas, government agencies, churches, and other civil orga-





nizing groups. In Central Appalachia, a regional planning approach has helped to channel efforts more coherently around future development priorities.

- 40 **Russia, Poland, and Romania illustrated successful stakeholder engagement processes during their coal sector reform programs.** In Russia, the government engaged extensively with the trade unions and with the Association of Mining Cities to explain the need for coal industry downsizing. In Poland, forceful miners' protests accompanied the launch of the coal reform program. The government responded by establishing extensive dialogue channels with the trade unions. This led eventually to the acceptance by the unions of the necessity of reform programs, and helped facilitate their effective and successful implementation. The stakeholder engagement led to the design and delivery of adequate income support measures known as "Miners Social Packages" which smoothed the transition for mine workers and communities. In Romania, engagement with mine workers and community representatives not only contributed to the acceptance of mine closures but also contributed greatly to the design of social and labor support measures for workers, their families, and communities. In addition, community involvement through a "community capacity building" activity included discussions on the repurposing of infrastructure and other assets which guided realistic expectations. These discussions had the added value of providing some limited direct employment opportunities as part of the mine's decommissioning. By contrast, Ukraine and the United Kingdom lacked significant stakeholder engagement. In the case of Ukraine, reforms were blocked. In the case of the United Kingdom, reforms were achieved but there were protracted conflicts with unions and mine workers over a two-decade period.

PILLAR 2: PEOPLE AND COMMUNITIES

- 41 **A Just Transition for All seeks to meet the needs of people, their families, and the community.** The coal industry ecosystem is vast and includes not only coal mines but also (i) coal users, such as power plants, industrial companies, district heating systems, and in less common cases, transport companies and residential users; (ii) transport systems carrying coal from mines to users (mostly railways); (iii) suppliers of goods and services to the coal mines; and (iv) in some cases social assets that provided auxiliary social services that were owned and operated by coal mines. Therefore, coal mine closures can result in substantial job loss in both the coal sector (mines and plants) and related industries. Furthermore, economic spillovers from coal mine closure extend to declining retail expenditures and employment in the service industry. Oftentimes, decades later coal-dependent communities still lag socially and economically far behind other areas of the country. The main reason being that rebuilding the economic

base of mono-industry regions is difficult and costly. When mining areas are already entrenched in intergenerational poverty, the challenge of economic revitalization is all the more difficult.

- 42 **Mitigating potential social and labor impacts from labor loss is best achieved when the needs and preferences of different groups of workers are understood.** Some coal sector workers are close to retirement; some are in the middle of their working lives; and others are younger workers not yet entrenched in the coal industry. Those close to retirement might prefer to leave the workforce with retirement packages and other social protection measures. The middle-age workers—who often have debts, immovable assets, and family commitments with deep roots in their community—are often unwilling to consider relocation to places where more work opportunities may be available, even when mobility incentives are offered. The younger workers are generally more ready and willing to be re-skilled and take alternative employment—even if the wages are lower than in the coal mining industry and if it means relocating. Differences also need to be recognized not only for workers employed in coal mines but also for those who lose their jobs in the other industries in the coal ecosystem—coal users, coal transport systems, goods and service suppliers, and coal industry social assets.

Lesson 4: A systematic process to mitigate social and labor impacts that starts before any labor layoffs occur can result in a more orderly, less stressful, and ultimately lower cost divestiture process.

- 43 **A three-stage approach (Figure 6) comprising pre-layoff planning, pre-layoff assistance, and post-layoff assistance provides governments with a social response framework for large-scale labor divestiture.** The first step in the process of pre-layoff planning is to identify who will lose their jobs. Very often divestiture comprises the total closure of a coal mine or other plant, but there are also instances of partial closures. In the case of partial closure, the organization and utilization of labor must be defined to reach desired efficiency. Next, an analysis of the skills and competencies of the existing personnel must be performed and, whenever possible, personnel meeting the new requirements should be selected from the existing staff. To note is the possibility to retrain some existing staff, and in some cases, new staff or managers with experience from more productive and competitive mines may even need to be hired. Any surplus personnel need to be divested. Pre-layoff planning should also look beyond the coal mines to be closed and include an analysis of possible indirect job losses, which could have a wider geographic range. If coal mines operate social assets and infrastructure, pre-layoff planning should also address how these assets and auxiliary social services will be sustained.



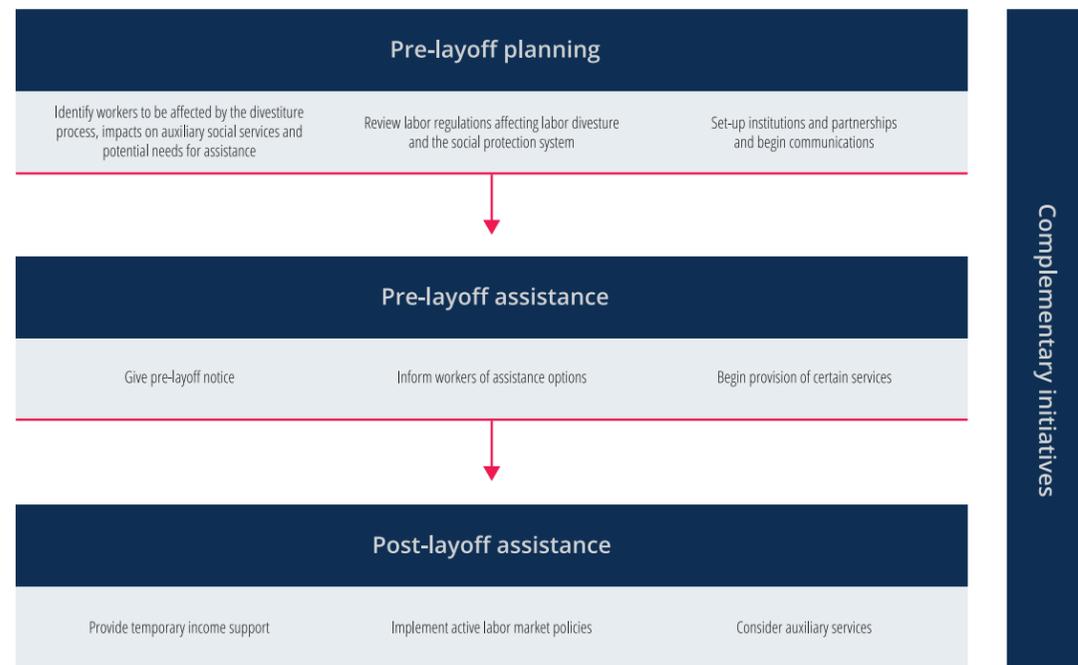


Figure 6: Stylized process of divestiture of labor

- 44 **Women may be potentially more impacted by closure programs.** By way of illustration, impacts for women include not only direct job loss but also increased burden of domestic responsibilities. When men lose their employment, intra-household tensions and possibly gender-based violence may increase. Gender relations, family, and community life may be disrupted through out-migration. For these reasons, engaging early on with not only men but also separately with women is critical to understand and respond to the range of potential impacts closure may induce. Due to diminished revenues, social services may be precariously underfunded, with families and affected community members turning to other social structures for help. For example, women’s nonprofit organizations in Silesia played a significant role in supporting individuals, families, and communities to respond to the Polish coal sector downsizing and layoffs by providing help, counseling, and shelter for those in need and by addressing domestic violence, alcohol, and substance abuse issues, which increased due to the layoffs.
- 45 **Gendered design in coal mine closure programs is important from the outset.** Women and men often have different jobs in the mining sector. For example, in Poland’s coal reform program the majority of surface workers were women who were initially excluded from receiving the Miners Social Package which was only available to underground mine workers and coal washing plant workers, all of whom were men. Eligibility criteria were adjusted to include surface workers, thus bringing women into the labor divestiture process. The Polish experience also showed that women were more willing to consider other job options while many of the male mine workers would not consider lower paying jobs in other sectors.

Lesson 5: Pre-layoff planning and assistance can prepare workers for impending layoffs.

- 46 **Affected workers need to be given sufficient periods of notice and be informed about lay-offs.** This will help smooth the adjustment for affected coal workers, especially for large-scale layoffs where demand for services will be high. It is critical that workers are clearly informed of the options and services they may be provided upon being laid off well before the actual layoff occurs. The period between the decision to divest and the time workers are to be displaced is one of the most difficult for those affected. To ease tensions and anxieties, early, honest, and comprehensive information for affected workers as well as trade union representatives and other stakeholders is critical. In Poland, considerable pre-layoff planning and preparation took place with the trade unions. Generous retirement and other income support was put in place before the mines were closed. Most importantly, the government avoided making any promises it could not keep.
- 47 **Start delivering social service programs before beginning layoffs.** Typical services started before workers lose their jobs, would include: (i) establishing eligibility for, and assessing interest in, temporary income support, active labor market programs, or retirement options (which might include early pension eligibility); (ii) profiling and worker skill audits to provide each worker with a clear understanding of their skills development and assistance needs; and (iii) providing initial jobs counseling and placement services. Box 2 describes a Canadian pre-layoff assistance service initiative, which effectively helped prevent displaced workers from falling into long-term unemployment. Providing these services should involve collaboration between workers, business, and local and regional public officials. The delivery of services works best on-site where the layoffs will occur. However, off-site local services may also be needed to respond to indirect job losses. Rapid deployment is critical.

Lesson 6: Post-lay off assistance, including temporary income support, can help sustain laid-off workers in a way that promotes continued participation in the labor market.

- 48 **Different instruments can be applied depending on the circumstance.** The precise design of income support instruments will significantly affect the coverage and adequacy of financial support, and workers’ incentive to actively look for jobs. Four main instruments for temporary income support include: (i) severance or other forms of termination payments; (ii) unemployment insurance; (iii) social assistance payments; and (iv) early retirement incentives.
- 49 **Termination payments can provide both quick-disbursing and longer-lasting income support for newly laid-off workers.** Termination payments can ei-



**Text Box 2****Canada's Industrial Adjustment Services**

Canada's Industrial Adjustment Services (IAS)—originally founded in 1963—and its successor organizations and initiatives consist of small units composed of specially trained staff who, on request, provide assistance to firms and communities facing large-scale labor redundancies. For instance, in the case of Canada's province of New Brunswick, activities supported by its Department of Post-Secondary Education, Training and Labor have recently included the setting up of a temporary service offering employees facing job loss with early retirement option information, labor market information, employment program information, and employment action planning. Also supported by the New Brunswick's Department of Post-Secondary Education, Training and Labor are human resource management for workers not affected by a layoff and for companies or sectors facing change or expansion. Evidence indicates that IAS support can be effective and cost-effective in terms of shortening periods of unemployment. Critical success factors are that the IAS focuses limited resources on the most vulnerable workers to ensure that public funds are used in the most efficient way, and that all local stakeholders are involved and work together to solve practical labor problems. IAS also demonstrates to the worst-affected workers that both the community and government care about the problems of adjustment.

Source: Authors based on Government of New Brunswick (2015) and Fretwell (2017)

ther take the form of regular severance payments that firms fund and pay out upon separation, or countries can set up special funds to dispense payments to laid-off workers in the affected industry or region. These special funds can be financed in various ways, although inevitably there will be considerable government contributions. Under both regular severance plans and special adjustment funds, benefits are usually disbursed either on a one-time basis or periodically through an annuity-type arrangement. There are advantages and disadvantages with each disbursement arrangement. On the one hand, annuity payments ensure that job losers will have continuous support. On the other hand, receipt of the full payment at the beginning of unemployment may allow for more productive use by recipients or for migrating to a place with better job prospects. In the case of Poland and Romania, World Bank-funded coal sector adjustment programs supported severance programs to coal workers.

- 50 **If an unemployment insurance system exists, this provides a second line of support for laid-off workers.** While on their own, unemployment insurance systems are often not well suited to provide income support in response to large-

scale jobs losses that lead to a longer-term unemployment period typical of labor displacement in the coal sector, some countries have used such systems to deliver additional support in times of crisis. For example, in the United States an extended benefits feature is triggered in times of high unemployment. Canada ties levels and durations of unemployment benefits to regional unemployment rates. It should also be considered that while unemployment insurance systems can in principle offer extended income support to displaced workers, very long benefit periods can create job search disincentives. There is evidence that extended unemployment benefit durations can account for a substantial share of the increase in long-term unemployment in the United States during the Great Recession of 2007 to 2009 (Farber and Valletta, 2015). Starting an unemployment insurance system in the context of rapid transition is also not a viable option since the insurance fund needs to accumulate contributions before it can pay out benefits.

- 51 **Social assistance payments can act as a social safety net for those who do not qualify for, or have exhausted, regular unemployment benefits.** In contrast to unemployment insurance benefits, social assistance payments are usually not funded through contributions by employers or employees but out of general government revenue and available not to specific groups of (laid-off) workers but to the population at large, subject to specific eligibility requirements. Social assistance payments are also usually means-tested, household-based, and at a lower level than unemployment benefits. The World Bank has supported many countries in the design, piloting, and scale-up of social assistance systems (including as part of the coal industry reform and restructuring programs) and more recently supported a growing number of “adaptive” social assistance programs specifically meant to be scaled up in response to economic or other shocks.
- 52 **Early retirement programs are sometimes used to incentivize older coal industry workers to exit the sector.** Early retirement programs have political value: they help limit labor disputes and reduce damage to morale. They are also a solution for some older laid-off workers who realistically have little chance to find re-employment. At the same time, they put a high fiscal burden on the pension system and, if not well targeted, may deprive the economy of productive human capital. Given the potentially high cost of early retirement programs, it may be preferable to offer social assistance payments to laid-off workers until they reach the regular retirement age, augmented by bonus payments for those who delay retirement.
- 53 **Future coal mine closure programs can learn from China's experience with heavy industries readjustment and privatization during the late 1990s and early 2000s.** This experience illustrates well the deployment of the different temporary income support instruments, and both success and certain limitations. In the case of China, many workers were offered early retirement and left the labor force. Those of working age were offered temporary income support and re-employment services to find





new employment. And those who were unable to find new jobs were provided “three guarantees” of extended temporary income support, unemployment insurance, and social assistance in the form of the urban “Dibao” program. While complete mitigation of the impacts of industries readjustment and privatization proved impossible, the country achieved some successes, and the episode served as an important catalyst for the creation of a modern social protection system. See Box 3.

Text Box 3

China’s “three guarantee lines” for unemployed workers

Many Chinese workers were affected by labor redundancies in the late 1990s. Employment guarantees for employees of state-owned enterprises were removed, and the enterprises laid off tens of millions of workers. According to official figures, about 28.2 million workers or more than 15 percent of the urban labor force were laid off between 1998 and 2003. Empirical analyses of China’s mass labor redundancies during this period document that for redundant workers, rates of labor force withdrawal were high, formal sector re-employment rates low, and earnings losses substantial.

To mitigate the effects of labor redundancies affecting tens of millions of workers, the government of China introduced an early retirement program for workers within five years of the retirement age. It first piloted and then scaled up the “Xiagang” re-employment program. The Xiagang program involved significant provisioning of public funds. It further required state-owned enterprises to provide temporary income support and re-employment services for up to three years to workers who had been made redundant. Laid-off workers could receive temporary income support for up to three years through the Xiagang program. Those who still lacked a job after three years could claim unemployment insurance benefits for a maximum of two years. In addition, families with laid-off workers could apply for income support from the urban “Dibao” social assistance program if they met the applicable eligibility criteria. Together, these programs were called the “three guarantee lines” to provide basic income support for unemployed workers and their families.

Research finds that the “three guarantee lines” including the Xiagang program achieved somewhat mixed success in terms of coverage, adequacy, and leakage of temporary income support and labor market impacts from its active labor market policies. Notwithstanding these challenges, the “three guarantee lines” served as an important catalyst for the creation of a modern social protection system in China.

Source: Authors based on Schmillen (2017).



Lesson 7: Active labor market policies offer services, programs, and incentives that can encourage and enable re-employment among laid-off workers.

54 **Active labor market policies have varying trade-offs.** Policies usually include one or a combination of the following three types: (i) employment services such as labor exchanges, vocational counseling and mobility assistance; (ii) education and training like institutional training or on-the-job training; and (iii) small business support services. There are certain trade-offs with respect to their typical costs per beneficiary and expected impacts, as illustrated in Figure 7.

Figure 7 – Stylized summary of active labor market policies

Active labor market policy	Typical costs per beneficiary	Mean impact on probability of employment		
		Short term	Medium term	Longer term
Employment services Labor exchanges Vocational counseling Mobility assistance	\$15–\$30 <i>(for labor exchanges)</i>	✓	✓	✗
Education and training Institutional training On-the-job training Comprehensive programs	\$250–\$1,000 <i>(for institutional training)</i> \$700–\$2,000 <i>(for comprehensive programs)</i>	✓	✓✓✓	✓✓✓
Small business support and subsidized employment Small business support Wage subsidies Community employment programs	\$500–\$3,000 <i>(for business support)</i> \$300–2,400 <i>(for subsidized employment)</i>	✗	✗	✓ <i>(for community employment programs)</i>

Notes:

- ✗ denotes an impact on a program beneficiary’s probability of employment of less than 0.05 standard deviations
- ✓ denotes an impact of 0.05 to 0.1 standard deviations
- ✓✓✓ denotes an impact of at least 0.1 standard deviations, all according to the meta-analysis by Card, Kluve and Weber (2015).

Source: Authors based on Betcherman et al. (2007) Card, Kluve, and Weber (2015), and Fretwell (2017).



- 55 **Employment services most effectively address situations when displaced workers have skills for which there is labor demand, but assistance is needed to access this demand.** Employment services generally come in three forms: (i) labor exchange services to support for job search; (ii) vocational counseling; and (iii) mobility assistance. Employment services might, for instance, involve the referral of electricians employed by the coal mine to employers outside of the coal sector looking to hire electricians. Vocational counseling can be effective as a self-standing service—e.g., assessing whether coal miners have aptitude and interest in specific occupations in other sectors—or as a screening device to control access to education and training programs.
- 56 **Mobility assistance can be particularly crucial when local labor markets are stagnant or dominated by a coal mine or plant in the process of being shut down.** There are substantial difficulties in rejuvenating coal mining economies by finding new “engines of economic activity” to replace coal mining as the economic mainstay. Therefore, labor mobility and migration are often the most effective ways forward for workers in “mono-industry” remote coal mining regions and communities with little connectivity to the rest of the economy where jobs may be available. In such instances, mobility assistance in cash or in kind can facilitate coal sector workers to move to regions with better employment opportunities. Mobility assistance is most effective when combined with complementary interventions to address constraints preventing people from taking advantage of economic opportunities in high productivity regions, such as reimbursement of transportation costs, moving and housing subsidies, information about jobs in receiving locations, or counseling sessions. See Box 4.
- 57 **Education and training programs help displaced workers to succeed in the labor market through re-skilling or retraining.** In the case of coal mine closure, education and training programs might, for instance, involve the retraining of operating engineers employed by the coal mine to operate and repair different but related types of equipment used outside of the coal sector. Three general categories of education and training programs can be distinguished. First, institutional training by private and/or public agencies. Second, on-the-job training by the private sector. Third, comprehensive training programs that combine institutional and on-the-job training. As a general principle, their design should be driven by demand rather than supply, and foster competition and efficiency in program delivery. For example, in West Virginia, Social Enterprise and Economic Diversification (SEED) Partners are community-based, grassroots organizations committed to building social enterprises, and then employ former coal workers who enroll in a 33-6-3 model.³³ Workers are offered a two-and-a-half-year contract consisting of 33 hours/week of paid work, accompanied by 6 credit hours of



Text Box 4

Constraints to labor mobility

Low labor mobility limits people’s ability to use their productive capacity to access jobs by moving to thriving regions. Of course, many issues may prevent individuals from moving to improve their job opportunities, including the monetary cost of moving. A program in Bangladesh provided minimal mobility payments to seasonal workers who successfully migrated to locations with jobs during the off-season. Some populations may face other or additional constraints, for example lack of information about job opportunities, lack of relatives and friends in areas of potential migration, the desire not to lose support networks in one’s current area, or difficulties facing spouses and children in moving. At the same time, policies can play a role limiting labor mobility, either by increasing migration costs or by failing to tackle the market failures that drive low labor mobility.

Market failures that reduce labor mobility include high living costs in urban areas, underdeveloped credit markets, and the lack of affordable (social) housing. In addition, cumbersome population registration requirements in some countries (especially formerly centrally planned economies) deter people from moving from lagging regions to leading ones. A survey in Ukraine shows that the population registration system is a key barrier to internal mobility. In Kazakhstan, newcomers are required to submit a document proving that he/she has housing of no less than 15 square meters (sqm) for one person, as well as a rental agreement.

The inadequate provision of education outside of urban centers can also be a barrier to mobility. Those who grow up outside of urban centers often receive lower quality education, which then constrains them in terms of meeting job market expectations. Educational attainment also tends to be lower outside of urban centers, and those with less education are often less willing to move to find jobs than those with more education.

This suggests that at least for some populations mobility assistance may need to go beyond “passive” support in the form of cash but include more “active” support, such as transportation, moving and housing subsidies, or counseling sessions.

Source: Authors based on Bryan et al. (2014) and World Bank (forthcoming).



higher education, and 3 hours of personal development mentorship. At the end of their contract, workers have gained invaluable work experience, earned an Associate's Degree, and gained clarity on life goals through mentoring.

- 58 **Small business support services can be offered to help laid-off workers to start businesses that respond to local demand for goods or services.** While small business services can be effective for a certain segment of the labor force, they can also be relatively more expensive than other active labor market services. Furthermore, they often attract a relatively limited number of displaced workers (only a minority of laid-off coal sector workers might be interested in starting their own business and at the same time be in the possession of the relevant aptitude and skills). The most common small business support services include: (i) technical assistance for start-ups; (ii) micro credits and grants; and (iii) small business incubators that provide small firms with an entrepreneurial environment, professional networking and mentorship opportunities, and financial and other resources all in one place. In Romania, the Social Development Fund was established to provide a microcredit program to support new business development. It was administered by local nongovernmental organizations. This program was pursued alongside more traditional re-skilling programs being offered by the national employment agency. Notably, these programs will not be successful in locations where there is no demand for goods or services, which may be the case in a mono-industry town when the mine closes and there is no income base to purchase goods or services provided by new small businesses.

PILLAR 3: LAND AND ENVIRONMENTAL REMEDIATION

- 59 **Comprehensive mine closure projects seek to repurpose lands and ensure adequate physical mine closure.** In effect, mine closure addresses both environmental and infrastructure risks. According to the World Coal Association, environmental reclamation should: (i) prevent negative impacts to soil, water, and air resources in and near mined areas; (ii) restore the quality of soils to their pre-mining level; and (iii) maintain or improve landscape and functional quality. An often-cited example of a best practice is the Coal-Mac Mining's Phoenix #2 in West Virginia. Backfill elevations were established to mimic the natural terrain, avoiding soil compaction and enhancing prospects for future use. Soil quality was improved to enable reforestation, planting two types of trees that would support wildlife, soil stability, and commercially valuable crop trees. Mine closure also requires securing the workings, waste dumps, and impoundments, and removing any post-closure mine site safety risks. This is particularly important to protect workers in underground mines that continue to operate near to closed underground mines that contain water. Lastly, restoration of

land occupied by mining facilities, including any usable infrastructure, will allow for future use by communities. Indeed, restored land and infrastructure can become an economic asset for communities in future regeneration initiatives. Take for instance the Appalachian Wildlife Center, a conservation education and research facility located on 19 miles of reclaimed mine land in the tri-state areas of southeastern Kentucky, northeastern Tennessee, and southwestern Virginia. It serves as an elk restoration and viewing center, creating jobs in a former mining area through tourism and conservation.

Lesson 8: Environmental reclamation is best addressed from the outset of mine planning.

- 60 **Mine closure and land reclamation requirements should be imbedded in the overall mine planning and permitting process from the outset.** An overview of the regulatory procedures and requirements for mine closure and related financial assurance is provided in the April 2016 Report Comparative Study of Financial Mechanisms for Environmental and Social Sustainability of Mine Sites after Closure in Kazakhstan prepared under the World Bank's Kazakhstan Joint Economic Research Program. For many coal mines this is a challenge, having been in production for decades, and mine closure plans and reclamation processes may be outdated or nonexistent. Where there is adequate lead time for planning mine closure, an updated environmental impact assessment is warranted. It should include considerations on water and air resource protection, land use, water use, disturbance to the natural environment, discharge of waste and pollutants, and protection of natural habitats. In Romania, the design of the physical mine closure of each mine was prepared by mining technical institutes. The Romania MCSEER loan supported the training of 650 technical staff in the International Federation of Consulting Engineers (FIDIC) contracts and standards, thereby creating a cadre of professionals fully capable of carrying forward mine closure activities in the country.
- 61 **Successful physical closure requires modern mine closure regulations and procedures, and competent institutions.** These are necessary both for the initial physical closure and reclamation as well as for long-term monitoring and managing of any potentially harmful legacy issues (such as protection of water quality in the surrounding area of a closed mine). The mine closure procedures should include measures to restore the land occupied by mining facilities to a condition suitable for future use. The procedural rules should ensure: (i) the safety of people during the closure or conservation process; (ii) protection of civil works and infrastructures





from hazardous events such as landslides, floods, and subsidence of soil; (iii) compliance with environmental requirements, including development of an Environment Impact Assessment for closure and conservation stages; and (iv) compliance with industrial safety requirements. In Romania, the government enacted 98 legal codicils specific to mining activities and mine closure, three laws, two emergency government ordinances, and two government ordinances. A mine closure manual based on modern international practice was issued by ministerial order (2001) and then formed the legal basis for the closure of all state-owned mines in Romania. The manual was later updated with additional annexes on the closure of private mines and annexes for consultation when social mitigation and consultation requirements were incorporated in the legislative framework for mine closures.

- 62 **Mine closure companies may deliver more efficient closures and draw labor and other resources from the closed coal mines.** Poland employed two mine closure companies, SRK and BSRK, to carry out the physical work of closing 16 of the country's coal mines between 1997 and 2002. SRK's and BSRK's responsibilities covered all aspects of closure, remediation, and reclamation. The physical mine closure and environmental reclamation were comprehensive and included a very broad range of activities: filling roadways and closing galleries with fly ashes mixed with mine water; recovering some potentially reusable underground equipment; undertaking ventilation and methane monitoring for safety purposes; continuous dewatering, necessary to prevent water hazards to the neighboring operating mines; control of saline water discharges to protect the local water systems; demolishing and clearing surface structures, buildings, plants, and equipment, and where necessary, stabilization of any work dumps; filling shafts with different materials and capping them off with a cement cap; demolishing existing buildings that could not be reused; dismantling surface structures and equipment; stabilizing waste dumps; liquidating tailings ponds; and reclaiming land either for industrial use which required clean up and ground leveling or for recreational use which required cultivation. Wismut uranium mining company also provided a good example of best practices in which a corporate entity was established in 1991 to restore and clean up the former mining and milling areas.³⁴
- 63 **The trend over the last 20 years has been to implement or strengthen the legal requirements for mine closure planning.** An initial closure plan should be prepared as part of the feasibility work for a new mining operation and approved before a mining license is issued. The initial plan may be somewhat conceptual since mining has not yet started, but even so it should include an estimate of the full cost of closure. The closure plan and cost estimate should then be updated on a regular basis thereafter. It is important to ensure the updated closure plans reflect the mining that takes place, and a plan should be ready in the event

that temporary or early closure takes place. Penalties should be enforced against companies for noncompliance, and charges against responsible officers and directors of companies should also be considered to increase compliance with environmental laws and mine closure requirements.

- 64 **Ukraine, Poland, and Romania demonstrated good practice on physical mine closure.** Interventions included ensuring that modern mine closure regulations and procedures were in place, adequate funding was available, and the necessary capabilities were in place. For instance, as part of its mining industry reform strategy the government of Romania prepared a time-bound program for the physical closure and environmental remediation of 174 mines where mining had stopped, and Romania established the Central Group for Mine Closures (CGMC) which successfully carried out the closure and environmental remediation of 31 mines. The closures included non-coal (metallic ore) as well as coal and lignite mines. Some 400 hectares (ha) of land were reclaimed and made available for new business and other activities in the mining communities; 9 preparation plants were rehabilitated, including several situated in the center of mining towns, thereby creating a healthy and safe environment for their inhabitants; and 8 tailing dams were reclaimed, significantly reducing the potential risk of dam failure with potentially catastrophic environmental and social impacts. Quarterly audits were undertaken of the closure works which served as a tool for monitoring and evaluation and resulted in the timely identification of potential issues.

Lesson 9: Financial assurance mechanisms can be an effective tool to guarantee funding availability.

- 65 **Insufficient funding is the biggest barrier to physical mine closure and land reclamation taking place in a satisfactory manner.** From the outset, a mine closure plan needs to be accompanied by a financial assurance mechanism. The mechanism would secure the costs that the government would incur if it had to implement a previously approved closure plan, in the event of default by the mine owner. The amount of financial assurance should be based on a site-specific calculation to implement the closure plan as approved using a fair market value estimate of closure costs. The methods and final estimate are typically subject to government review and approval. The estimated closure costs could be significant, with immediate placement of a portion of the obligation providing some guarantee to the government, while limiting the burden on the company.
- 66 **There are a range of possible financial assurance mechanisms.** Cash and cash equivalents are the most secure forms of financial assurance, but they can have a significant impact on the finances of a mining company. Other mechanisms, which are widely used, include bank guarantees and letters of credit. Corporate





guarantees are strongly advised against. Ideally, the mine closure plan should be fully funded at the start of mining and progressively increased over time in line with the revised costs estimates when the Mine Closure Plan is updated. However, this may not be practical, and instead the financial assurance may be progressively built up over time with funds paid in pro-rata and/or credit increased over a limited period. For example, in Chile, the initial portion is 20 percent of the obligation. Annual increases in the financial assurance should be defined based on the current mine life, but the time required to put the total funding in place probably should not exceed 15 years or half of the remaining mine life, whichever is less.

- 67 **Many countries are now turning to financial assurances to provide security should a mining operator be unable to meet its closure obligations due to insolvency and abandons the mine.** Financial assurance has the added benefit of improving closure plans and cost estimates. This can result in shifting the costs of unexpected or premature mine closures away from the government to the mine owner. Any cash or cash-equivalent payments and costs for financial assurance should be deductible for income tax purposes in the period that they are made. There are many financial instruments available to fund for financial assurance obligations with the most common summarized in Box 5.

Text Box 5

Most common financial instruments

- (i) Full payment in cash or cash equivalents (certified cheques, bank drafts, term deposits, government issued bonds);
- (ii) A bank guarantee;
- (iii) An irrevocable standby letter of credit;
- (iv) Contributions into an approved trust (with further details on the use and governance rules set out in local laws and varying by local customs and requirements);
- (v) A surety bond or insurance policy to fund the closure costs in the event the proponent does not;
- (vi) Assignment of income flows (fixed rent instrument; Ore Sale Contract Cession; Pledge on Export Returns; and
- (vii) A corporate guarantee.

Source: Meredith Sassoon 2009, *Financial Surety World Bank*.

Conclusion

- 68 **Lessons from past coal mine closure programs and the broader literature offer insights for future coal sector interventions.** Over the last half century, large-scale changes to coal industries across Europe and, more recently in the United States and China, have resulted in significant job losses with considerable impacts to workers and communities across the coal value chain. The drivers behind these sector adjustments persist today, making future closures likely across Asia and Europe, and to a lesser extent Central Asia and Africa. The social risk posed by rapid coal mine closures, compounded by the variations in coal mine ownership, points to the important leadership role required of governments to plan and prepare for this eventuality. Lessons point to the necessity for early stage planning, consistent dialogue with stakeholders, and methodical sequencing of the provision of income support and active labor market policies. Financing and technology solutions are promising avenues for environmental remediation and land reclamation, which are often overlooked areas. In fact, a window of opportunity exists to improve on past closure experiences and record new best practices for industry and society at large.
- 69 **Efforts toward a Just Transition for All reside at the heart of future coal mine closures.** As discussed over the course of this report, a successful mine closure program is one that minimizes social conflict by mitigating impacts on affected workers and communities. This is not an easy task. Whereas the immediate impacts of income loss and unemployment can at least to some extent be mitigated through the multiple instruments discussed in Pillar 2, important questions remain regarding the desirability and feasibility of the long-term revitalization of affected mono-industry towns. Mobility support for unemployed workers and their families to move to areas with strong economies and new job prospects may be the most effective way forward for those in communities having low connectivity to strong economic regions. Disappointingly, few studies have been undertaken to assess outcomes of efforts to reorient coal mining regions from decades ago. Evidently, a profound research gap exists to which future efforts can certainly contribute.
- 70 **Large-scale action and learning partnerships can support future best practice.** A sustained commitment will be required from several stakeholders—governments, international financial institutions, the private sector, and civil society—to ensure this is achieved. Forward looking, governments can augment the findings from this report with country- and region-specific diagnoses of the drivers to the reform of their respective coal sectors, their social protection needs, and





environmental risks. Collaboration is also necessary to implement the support programs for laid-off workers, their families, and their communities focused on helping them get back into productive employment, with programs and initiatives that facilitate broad-based economic growth and job creation by the private sector. Strong analysis to inform decision making, together with mobilization of public and private sector financing, will be critical. Calling on all those with expertise and resources will require leveraging existing, and putting in place new, platforms, partnerships, and ways of working that can catalyze action at the scales commensurate to the needs of a Just Transition for All.

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End Notes

- 1 Coal is used here as a proxy to cover hard coal (including anthracite) and lignite (including brown coal).
- 2 The World Bank made eleven loans from 1996–2004, to support coal mine closures, as follows: (i) Russian Federation Coal Sector Adjustment Loan (SECAL I); (ii) Russian Federation Coal Sector Restructuring Implementation Assistance Project (IAP); (iii) Russian Federation Coal Sector Adjustment Loan (SECAL II); (iv) Ukraine Coal Pilot Project Loan; (v) Ukraine Coal Sector Adjustment Loan (SECAL); (vi) Poland Hard Coal Sector Adjustment Loan (SECAL I); (vii) Poland Hard Coal Sector Adjustment Loan (SECAL II); (viii) Poland Hard Coal Social Mitigation Loan; (ix) Poland Hard Coal Mine Closure Loan; (x) Romania Mine Closure and Social Mitigation (MCSM) Loan; and (xi) Romania Mine Closure, Environmental and Socio-economic Regeneration (MCESR) Loan. See Bibliography for a list of documents.
- 3 The Just Transition for All concept builds on the International Trade Union Confederation’s (ITUC) concept of a “Just Transition.” The ITUC’s definition is ‘*A just transition brings together workers, communities, employers, and government in social dialogue to drive the concrete plans, policies, and investments needed for a fast and fair transformation. It focuses on jobs, livelihoods, and ensuring that no one is left behind as we race to reduce emissions, protect the climate, and advance social and economic justice*’. The “Just Transition for All” complements this concept by also envisioning the reform of labor and social policy and institutions to ease the disruption faced by a wide range of people directly and indirectly affected by the transition toward clean energy, as well as to support them in their post-transition jobs and lives.
- 4 Global dialogues on meeting the Paris Climate Agreement’s targets have started to address the “Just Transition” for coal sector workers within the context of phasing down coal consumption and transforming energy systems. Institutions and organizations that advocate for reduced coal use have also turned their attention to facilitating a Just Transition from coal with initiatives that aim to facilitate workforce transitions, development of employment opportunities, and quality jobs in relation to the implementation of climate change mitigation policies.
- 5 The Just Transition for All concept builds on the International Trade Union Confederation’s (ITUC) concept of a “Just Transition.” The ITUC’s definition is ‘*A just transition brings together workers, communities, employers, and government in social dialogue to drive the concrete plans, policies, and investments needed for a fast and fair transformation. It focuses on jobs, livelihoods, and ensuring that no one is left behind as we race to reduce emissions, protect the climate, and advance social and economic justice*’. The “Just Transition for All” complements this concept by also envisioning the reform of labor and social policy and institutions to ease the disruption faced by a wide range of people directly and indirectly affected by the transition toward clean energy, as well as to support them in their post-transition jobs and lives.
- 6 Coal is used here as a proxy to cover hard coal and lignite.
- 7 The eleven loans made by World Bank were as follows: (i) Russian Federation Coal Sector Adjustment Loan (SECAL I); (ii) Russian Federation Coal Sector Restructuring Implementation Assistance Project (IAP); (iii) Russian Federation Coal Sector Adjustment Loan (SECAL II); (iv) Ukraine Coal Pilot Project Loan; (v) Ukraine Coal Sector Adjustment Loan (SECAL); (vi) Poland Hard Coal Sector Adjustment Loan (SECAL I); (vii) Poland Hard Coal Sector Adjustment Loan (SECAL II); (viii) Poland Hard Coal Social Mitigation Loan; (ix) Poland Hard Coal Mine Closure Loan; (x) Romania Mine Closure and Social Mitigation (MCSM) Loan; and (xi) Romania Mine Closure, Envi-





- ronmental and Socio-economic Regeneration (MCESR) Loan.
- 8 The World Bank made eleven loans for coal sector adjustment as follows: (i) Russian Federation Coal Sector Adjustment Loan (SECAL I); (ii) Russian Federation Coal Sector Restructuring Implementation Assistance Project (IAP); (iii) Russian Federation Coal Sector Adjustment Loan (SECAL II); (iv) Ukraine Coal Pilot Project Loan; (v) Ukraine Coal Sector Adjustment Loan (SECAL); (vi) Poland Hard Coal Sector Adjustment Loan (SECAL I); (vii) Poland Hard Coal Sector Adjustment Loan (SECAL II); (viii) Poland Hard Coal Social Mitigation Loan; (ix) Poland Hard Coal Mine Closure Loan; (x) Romania Mine Closure and Social Mitigation (MCSM) Loan; and (xi) Romania Mine Closure, Environmental and Socio-economic Regeneration (MCESR) Loan.
 - 9 The case studies presented in this report are taken largely from a companion draft EEX report “Coal Sector Adjustment: Case Studies of Coal Mine Closure in Different Regions of the World,” World Bank, forthcoming.
 - 10 Germany remains a major producer of lignite and brown coal.
 - 11 For this paper, “coal” includes anthracite and “lignite” includes brown coal. Unless otherwise noted, all units, including for the United States, are in metric tons, with one metric ton equal to 1,000 kg and to 2,204.6 pounds.
 - 12 See: https://www.bls.gov/oes/current/naics4_212100.htm (Accessed 27th April 2018). These numbers include all facets of a coal mine company: executives, management, underground and surface miners, engineers, health and safety, etc.
 - 13 See: <https://www.bls.gov/oes/current/oes518013.htm> (Accessed 27th April 2018).
 - 14 Indeed, laid-off mining workers likely earn higher wages with more benefits as compared to alternative low-skilled jobs. This is likely due to several factors. First, miners are paid a “compensating wage differential,” namely higher pay in order to compensate for the dangerous and physically strenuous labor required in coal mining. Second, years of strong unions will boost mining wages more than in less organized low-skilled industries. Third, laid-off mining workers may enjoy wage increases due to tenure, while the offered wage for a new worker in an alternative industry will not recognize tenure in the mining sector. Fourth, and more relevant for developed economies, is the scarcity of demand for low-skilled workers, which pushes down offered wages in jobs that former miners may be suitable for.
 - 15 Consider for instance the International Trade Union Confederation’s concept of a “Just Transition,”—‘A just transition brings together workers, communities, employers, and government in social dialogue to drive the concrete plans, policies, and investments needed for a fast and fair transformation. It focuses on jobs, livelihoods, and ensuring that no one is left behind as we race to reduce emissions, protect the climate, and advance social and economic justice’.
 - 16 Global dialogues on meeting the Paris Climate Agreement’s targets have started to address the “Just Transition” for coal sector workers within the context of phasing down coal consumption and transforming energy systems. Institutions and organizations that advocate for reduced coal use have also turned their attention to facilitating a Just Transition from coal with initiatives that aim to facilitate workforce transitions, and develop employment opportunities and quality jobs in relation to the implementation of climate change mitigation policies.
 - 17 This report recognizes that coal mine closure intersects with the broader issue of economic diversification and rejuvenation—a diverse research area beyond the narrower scope of this report on short-to-medium issues on closure.
 - 18 Vriens, Lauren. 2018. “The End of Coal: Alberta’s coal phase-out.” International Institute for Sus-

tainable Development (IISD), Manitoba, Canada. May 2018.

- 19 Interview with Brandon Dennison, CEO of Coalfield Development Corporation, 25th April 2018 noted that out-migration depends on social networks in destination areas, which can be very important for providing a basis of security for the move to another location.
- 20 These figures do not include job losses in the subsidiary businesses linked to the coal industry.
- 21 Exact figures for coal mining employment in China varies by source. The Annual Mining Report 2018 submitted by China to the Asia-Pacific Economic (APEC) 12th Mining Task Force Meeting, Port Moresby, Papua New Guinea 21-22 August 2018, reported 2.5328 million employees in energy minerals in 2017.w
- 22 The New Policies scenario is IEA’s central scenario that is based on policies that are in place and announced.
- 23 Energy intensity is the ratio of primary energy supply to gross domestic product. Thus, a decrease in energy intensity implies that the economy is more energy efficient.
- 24 Heat pumps and air conditioning units are roughly twice as efficient compared to those available 15 years ago. Coupled with improved insulated buildings, energy efficiency has improved considerably.
- 25 Source: “World Energy Balances (2017 Edition),” the International Energy Agency (IEA).
- 26 International Gas Union (IGU) estimates that global gas prices, at \$3.35 per million British Thermal Units (MMBTU) were the lowest ever recorded in their surveys that started in 2005.
- 27 The IGU states that Liquefied Natural Gas (LNG) trade has reached record levels for the last three years in a row.
- 28 Lazard 2017 LCOE Report available at <https://www.lazard.com/perspective/levelized-cost-of-energy-2017>.
- 29 Shale gas production in the United States increased rapidly from 2 trillion cubic feet (TCF) in 2007 to 17 TCF in 2016.
- 30 Coal-fired power in the United States was responsible for about half of all electricity production before shale gas became available. In 2017 gas-fired power plants edged out coal-fired production for the first time.
- 31 Careful planning is needed to maintain reliable energy supply at low cost, without which support for the transition would be jeopardized. The United Kingdom undertook detailed planning during the 1980s to facilitate a transition to support increased use of low-cost natural gas from the North Sea. This process included both the physical aspects of energy supply as well as the policies to support unbundling and privatization. Germany introduced policies in 2004 to support increased use of wind and solar power, using feed-in tariffs to help address environmental externalities initially, followed by auctions once the cost of renewable energy options had decreased. Lastly, the states of California and South Australia found that rapid deployment of solar and wind created problems for system reliability and introduced a market for energy storage that successfully addressed this issue.
- 32 Later renamed “Agentia Zonelor Miniere”—(AZM).
- 33 For more information on Coalfield Development Corporation see: <http://coalfield-development.org/> (Accessed 27th April, 2018).
- 34 For more information see: <http://www.wismut.de/en/> (Accessed 10th June, 2018).





Managing Coal Mine Closure
Achieving a Just Transition for All