At the Crossroads: Balancing the financial and social costs of coal transition in China

GSI REPORT

IISD International Institute for Sustainable Development

Global Subsidies Initiative

Richard Bridle
Lucy Kitson
Hongxia Duan
Lourdes Sanchez
Travers Merrill

July 2017

Published by the International Institute for Sustainable Development.

International Institute for Sustainable Development

The International Institute for Sustainable Development (IISD) is one of the world's leading centres of research and innovation. The Institute provides practical solutions to the growing challenges and opportunities of integrating environmental and social priorities with economic development. We report on international negotiations and share knowledge gained through collaborative projects, resulting in more rigorous research, stronger global networks, and better engagement among researchers, citizens, businesses and policy-makers.

IISD is registered as a charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Government of Canada, provided through the International Development Research Centre (IDRC) and from the Province of Manitoba. The Institute receives project funding from numerous governments inside and outside Canada, United Nations agencies, foundations, the private sector and individuals.

Head Office

111 Lombard Avenue, Suite 325
Winnipeg, Manitoba
Canada R3B 0T4

Tel: +1 (204) 958-7700
Website: www.iisd.org
Twitter: @IISD_news

About GSI

GSI is an initiative of the International Institute for Sustainable Development (IISD). GSI is headquartered in Geneva, Switzerland and works with partners located around the world. Its principal funders have included the governments of Denmark, the Netherlands, New Zealand, Norway, Sweden and the United Kingdom.

Global Subsidies Initiative

International Environment House 2,
9 chemin de Balexert
1219 Châtelaine
Geneva, Switzerland
Canada R3B 0T4

Tel: +1 (204) 958-7700
Website: www.iisd.org/gsi
Twitter: @globalsubsidies

At the Crossroads: Balancing the financial and social costs of coal transition in China

July 2017

Written by Richard Bridle, Lucy Kitson, Hongxia Duan, Lourdes Sanchez and Travers Merrill

IISD gratefully acknowledges the support of the Foreign and Commonwealth Office of the United Kingdom to this publication. The views expressed here do not necessarily reflect the views of the Government of the United Kingdom and should not be attributed to them

Executive Summary

The boom and eventual bust of resource-dependent regions has played out across the world many times over the last 50 years. As extractive industries go into decline due to resource exhaustion, competition from elsewhere or changing consumption of energy, demands are made for subsidies to revive the industry and maintain jobs. Concurrently, policy-makers, realizing that the decline of a resource extraction industry will cause social and economic hardship, begin the search for new industries to replace lost jobs and maintain economic development.

In China, concerns over air pollution, carbon emissions and the changing economic structure have led to a turning point. At the 12th Annual People's Congress, Prime Minister Li Keqiang pledged to "make our sky blue again," highlighting plans to tackle air pollution (Bloomberg, 2017). Coal consumption is predicted to fall over the coming decades. Due to growing overcapacity concerns, 150 GW of coal-fired power projects have been cancelled or delayed between 2016 and 2020 (Reuters, 2017b). In coal-producing regions such as Shanxi province, where coal is the major industry, reform plans create a threat to employment and the economy.

In Shanxi, coal industry reform started in 1999, initially to improve safety and efficiency, with the closure of illegal and small mines and the consolidation of the industry. As a result, safety and environmental performance of coal mines have improved and coal state-owned enterprises (SOEs) have grown large. Typical coal mines now have the capacity to produce over 900,000 tonnes per year. In 2013 the coal price fell, plunging the indebted coal industry into losses. To avoid defaults, SOEs are reported to have reduced the salaries of workers and restricted the operating hours of the coal mines. In addition, the regional government took steps to address debt and help the SOEs through the crisis. There is currently a tension between the level of ambition to reform the coal industry at the national level, where there is clear government commitment to reduce the role of coal in the electricity sector, and the provincial level, where coal remains at the centre of industrial policy.

This report examines the current status of the coal transition in Shanxi and proposes recommendations for how reform can be managed to ensure that economic, social and environmental factors are built into the process. These recommendations draw on international experience, in particular, the experience summarized in case studies from South Wales in the United Kingdom, Appalachian Kentucky in the United States and Asturias in Spain. The situation in Shanxi shares a number of key similarities with the international examples in this report. The economies of these regions were heavily dependent on the coal industry and much of the local establishment had a strong interest in continuing to centre the economy on coal production. This establishment was confronted by political pressure to reform due to economic pressures, including resource exhaustion and a lack of competitiveness, leading to: losses by SOEs in Wales and Asturias; environmental pressures, including health concerns from a legacy of coal-related pollution, in particular in Kentucky; and changes in national political priorities, such as the need to comply with European Union (EU) restrictions on state aid in Asturias.

International policy-makers are increasingly deploying policies to restrict the use of coal and to regenerate former coal-producing regions. For example, the EU has agreed to phase out all state aid to the coal industry by 2018 (EU Business, 2010); European energy companies have committed not to build any new coal plants after 2020 (United Nations Framework Convention on Climate Change, 2017); Ontario (Canada) has completely phased out coal-fired power generation (Harris, Beck, & Gerasimchuk, 2015); and many other countries have introduced additional regulations and taxes restricting coal production and use.

International experience shows that there is a diverse range of policies used to support the closure of coal mines and the transition of the economy away from coal. Based on the case studies, three main types of policies are identified:

- Policies that **strengthen the local economy**, including the support of other local industries, innovation, education and entrepreneurship as well as the facilitation of investment into targeted sectors.
- Policies that **improve the physical infrastructure and environment**, including transport, housing, telecommunications and the rehabilitation of closed coal mine sites.
- Policies that **revitalize community cohesion** and support for economic transformation, by reinforcing the local culture and identity and providing required welfare benefits to avoid a sudden decline in living standards.

Unequivocally successful examples of management of the decline of coal production are rare, underlining the scale of the challenge facing Shanxi. Many regions have enacted effective policies to tackle one aspect of the challenge. For example, the establishment of welfare programs that address short-term poverty, or the promotion of inwards investment from large employers through tax breaks and subsidies. But there are few examples of really comprehensive programs that have the power to transform a region. The key finding of this report is the need to develop policies to tackle all aspects of transition. Furthermore, in light of the current challenges facing Shanxi and the international experience explored in the case studies, the following four specific recommendations are made:

1. **Establish a comprehensive development plan** for Shanxi and other coal-producing regions that analyzes the potential impact of coal industry decline and evaluates possible policies to address economic, environmental and social impacts.
2. **Identify new industries** – Coal-producing regions should embark on a process to identify industries that could eventually generate significant employment and focus policies to support these fledgling industries.
3. **Make the polluter pay** – Consider how environmental taxes and charges could be used to fund the transition. Revenues from carbon trading schemes, subsidy phase-outs or increased resource taxes could help to accelerate the transition.
4. **Stakeholder engagement** – An open dialogue with communities, industry associations and other interested parties will help to identify challenges and issues with reform, preventing possible negative implications.

Shanxi and other coal-producing provinces of China need to go through the difficult transition away from the current status of resource-dependent regions to a diversified economy. The international experience testifies that Shanxi is by far not alone in this situation, and that there is a future after coal.

Table of Contents

Abbreviations and Acronyms

ARC	Appalachian Regional Commission
BAU	business-as-usual
FIT	feed-in tariff
FYP	Five-Year Plan
GHG	greenhouse gas
GSI	Global Subsidies Initiative
GSI-IF	GSI Integrated Fiscal model
INDC	Intended Nationally Determined Contribution
kWh	kilowatt hour
LGEDF	Local Government Economic Development Fund
Mt	million tonnes
MWh	megawatt hours
PSOE	Spanish Socialist Workers Party
R&D	research and development
SCC	social cost of carbon
SOE	state-owned enterprises
tCO_2e	tonnes of carbon equivalent
TJ	terajoule
WDA	Welsh Development Agency

1.0 Introduction

The boom and eventual bust of resource-dependent regions has played out across the world many times over the last 50 years. When energy prices are high and coal is cost-effective to extract, the coal industry expands, bringing with it jobs and growth in political influence (see Figure 1). As coal extraction costs increase, easily extractable resources are exhausted or labour costs rise compared with competing regions; mines struggle to remain competitive, leading to calls for subsidies to safeguard the industry. Eventually, the high cost of support creates pressure to reform the industry, remove subsidies and allow the industry to decline. As the coal industry declines, workers face job loss, and coal mining regions can experience economic and social disruption as they struggle to find new industries to replace coal.

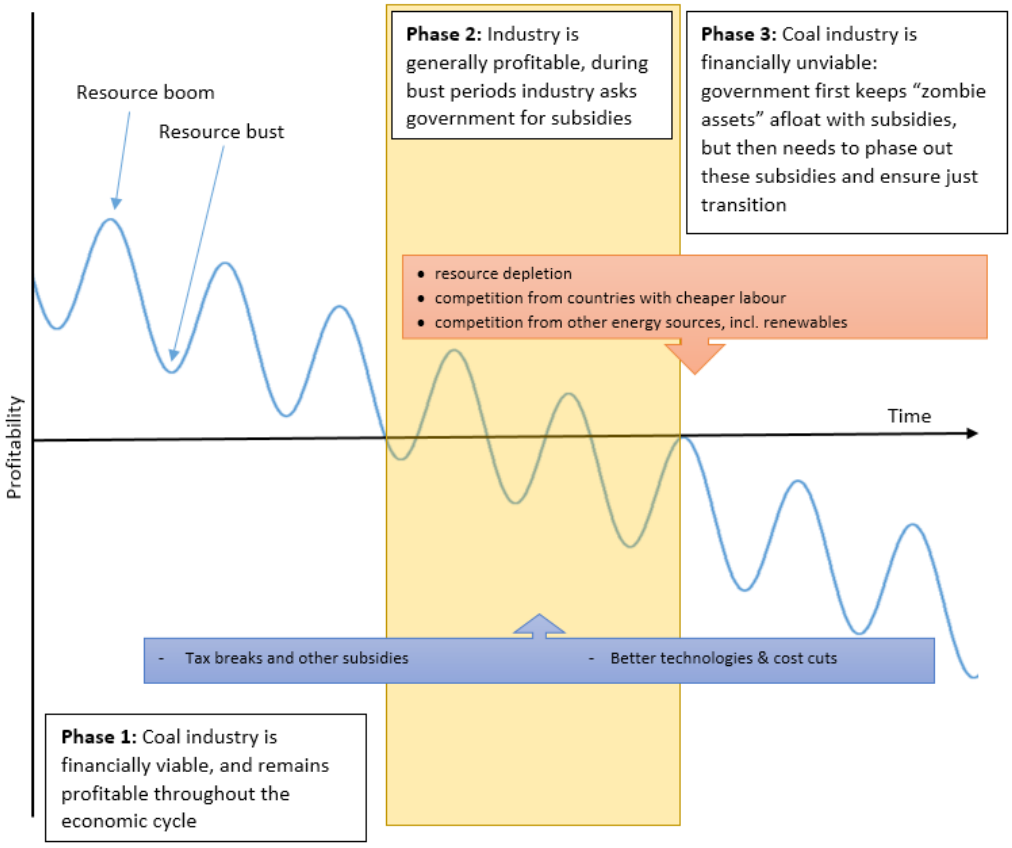


Figure 1. Declining profitability of extractive industries (Author's diagram)

Note: "Zombie" assets are those that are reliant on subsidies to continue operation (Gerasimchuk et al., 2017)

The increasing competiveness of renewables and concerns over air pollution, greenhouse gas emissions and impacts on landscapes have contributed to a political landscape that is increasingly inhospitable to the production and consumption of coal in many countries, including China. Investors are also showing increased concern with respect to coal: in 2015 Norway's USD 90 billion government pension fund announced that it would no longer invest in coal (Schwartz, 2015), and many private investors, fearing a wider crackdown of coal use, are divesting from coal companies.

As a result, now even more than ever before governments are revising their policy objectives. Support to coal, which once made sense for securing energy supply and regional development, is being phased out or is under threat of being phased out. Among others, the EU has agreed to phase out all state aid to the coal industry by 2018 (EU Business, 2010); European energy companies have committed not to build any new coal plants after 2020 (United Nations Framework Convention on Climate Change,

2017); Ontario (Canada) has completely phased out coal-fired power generation (Harris et al., 2015); and many other countries have introduced additional regulations and taxes restricting coal production and use.

As the world's largest producer and consumer of coal, China faces a particular challenge. Coal-fired power generation has traditionally powered China's economic development, and coal mining has in itself been a major source of employment in many regions. Subsidies to the coal industry have increased coal use at an aggregate level by artificially reducing the price of energy derived from coal. However, the environmental impacts of coal use have become increasingly pronounced, with air quality deteriorating to the point where the leadership is making this one of its primary policy goals. Accordingly, the government has cancelled or delayed at least 150 GW of coal-fired power projects between 2016 and 2020 (Reuters, 2017b). This tension between jobs and environment suggests that policy-makers face a delicate balancing act in ensuring both continued socioeconomic stability and environmental improvement.

Numerous examples from across the globe show that a reduction in employment caused by reform of the industry in general, and subsidy reform in particular, can have profound social impacts. Without a coherent plan to manage these impacts, policy-makers risk a delay in reform and ongoing fiscal and environmental costs, or, if reforms are pushed through, severe social impacts on mining communities. The impetus is therefore to develop policies that could deliver a transition away from coal without the undesirable social impacts.

This report studies both fiscal and social dimensions of the coal transition in China, with the focus on Shanxi province, and draws on some lessons learned from international experience. The report is structured as follows. First, we review the coal industry in Shanxi province, to explore the recent history of reform and the challenges facing the province. Shanxi has been selected for special consideration due to its status as the largest producer of coal in China and the historic heartland of the Chinese coal industry. The assessment is based on a series of meetings and workshops with policy-makers, industry associations, state-owned enterprises (SOEs) and academics, supplemented with a literature review.

Second, we present three international examples of coal industry transitions, from the United Kingdom, the United States and Spain, respectively. The case studies review the experience of managing transition and attempting to develop policies to mitigate the social impacts of coal industry decline and to promote economic sustainability in former coal mining communities. Finally, we offer policy options for Shanxi and other provinces facing similar challenges and outline how to avoid the pitfalls and learn from the successes of other jurisdictions.

Third, international experience is evaluated in the context of the challenges facing Shanxi to identify policies and insights that could feed into the decision-making process to promote coal industry reform that respects social, environmental and economic constraints. The findings are summarized in a series of policy recommendations.

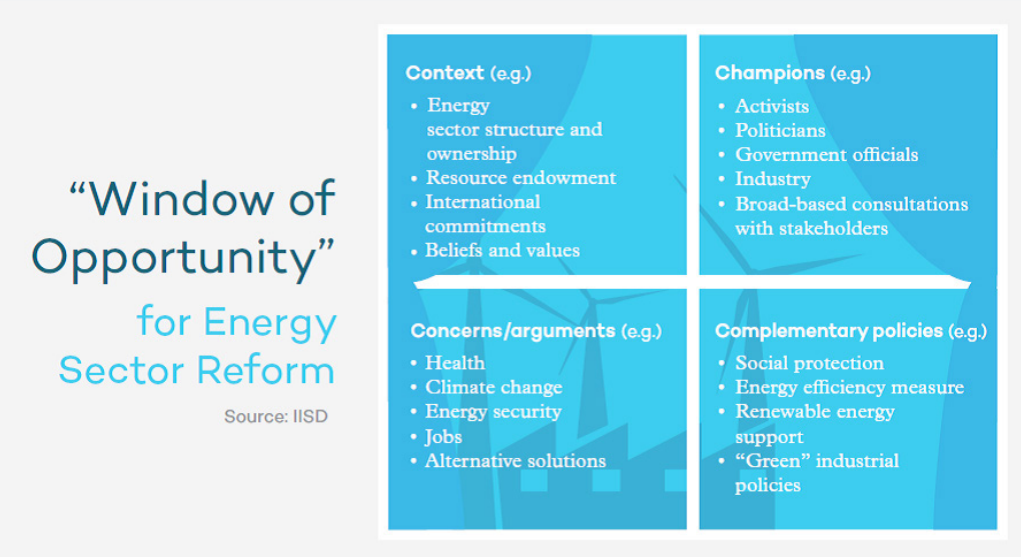
By drawing on previous experience to inform future policy development, this report aims to promote collaboration between countries that are at various points in their reforms and the adoption of policies that reflect the social, economic and environmental strands of sustainable development. No process of economic transition is without social cost, but by learning from the past, the negative impacts can be minimized.

The "window of opportunity" framework developed by IISD is used to structure the analysis (Harris et al., 2015). This framework is described in Box 1. At the beginning of each section, a summary presents the main findings of the framework. Each section is structured around the categories presented in the framework.

Box 1. The "window of opportunity" framework

This framework helps to identify the conditions required for successful reform in the energy sector. With favourable conditions in each of the four window panes below, reform can be successful.

- **Context**: What is the situation of the coal industry and what are the economic, social and environmental challenges that need to be addressed?
- **Champions**: Who are the politicians, government officials, industry representatives, activists and stakeholders that can promote the reform process?
- **Concerns/arguments and the case for reform**: What are the concerns about, or arguments for and against, reform and the applied policies?
- **Complementary policies**: What additional policies exist or should be put in place to support reform?



2.0 Coal Transition in China: Focus on the Shanxi Province

Shanxi Province in the North China region is the heartland of China's coal industry, with an economy that is dependent on coal production. Recent declines in the coal market have hit the province hard as declining demand and prices have led to reduced revenue for SOEs and local government, and have reduced operating hours in mines. In the context of national policy, reform of the sector seems inevitable as coal plays a declining role in China's energy mix, and, in turn, this reform is likely to necessitate economic diversification.

The local political environment is complicated. The coal industry has a strong influence on local policy, calling for measures to protect the industry and resisting measures that could undermine coal operations. However, despite their influence at the provincial level, SOEs are faced with international economic realities and the policy direction of the central government, and thus need to balance their books, comply with political objectives to reduce output and provide jobs.

Policies are in place and under development to deal with the environmental legacy of the coal industry. Major impacts of the coal industry include the emission of particulates, oxides of nitrogen, sulphur dioxide and toxic trace elements from Chinese coals to soil, air and water. This pollution leads to many health problems, including fluorosis, and air pollution is estimated to cause millions of pollution-related deaths (Chen et al., 2014; Institute for Health Metrics and Evaluation, 2016). Beyond the environmental impact of the coal industry, there is a need to find jobs for former coal miners and the need to diversify the economy. This chapter explores these and possible future policies through the "window of opportunity" framework set out below. The analysis draws on a series of meetings and interviews that were conducted with academics, government officials, SOEs and coal miners of Shanxi province between October and December 2016.

CONTEXT

- Coal-dependent economy
- Loss-making coal industry
- Large coal reserves

CHAMPIONS / KEY ACTORS

- Coal industry influence in political process
- SOEs and their essential role in Shanxi's society
- Chinese central government through their Five-Year Plan adapted to Shanxi

CASE FOR REFORM

- Concerns around the impact on the environment and public health of the coal industry
- Compliance with national policy objectives
- Improve economic resilience through diversification

COMPLEMENTARY POLICIES

- Employment opportunities for people losing jobs in the coal sector
- Funding for resettling populations affected by subsidence and environmental damage
- Investments in ecological restoration
- Promotion of coal-gas and coal-chemical technologies

Figure 2: A window of opportunity for coal industry reform in Shanxi

2.1 Context

The province of Shanxi in northern China is home to around 32 million people. In many respects, Shanxi can be considered a traditional resources-oriented economy (Department of Land Resources of Shanxi Province, 2012). In 2015, the production and consumption of coal and coke, the metallurgical industry and the generation of electricity provided 74 per cent of total industrial added value (Shanxi Bureau of Statistics, 2017). The coal industry is at the heart of Shanxi's economy; Shanxi has coal reserves of around 900 million tonnes, 25 per cent of the total reserves in mainland China (Yang, Wang, Shao, & Wang, 2015). Shanxi is also home to around one third of China's bauxite reserves, has a large mineral and chemical industry and has a large military presence. The region has a lower level of economic development than the national average, with 2.32 million people having an annual per capita income of less than CNY 3,000, a benchmark for poverty, in 2016 (Shanxi Daily Newspaper, 2016).

Coal industry reform started in 1999 with the closure of illegal and small coal mines to reduce the increasing number of accidents (see Table 1 for a timeline of reforms from 1999 to 2009). The 11th Five-Year Plan (FYP) (2006–2010) triggered the consolidation of the coal industry, under the assumption that this would allow greater control over safety and environmental performance of coal mines. As a result, the coal SOEs (see Box 2) have grown large in recent years, as they have absorbed former private mines into their operations. Typical coal mines now have a capacity to produce above 900,000 tonnes per year in Shanxi. A summary of the status, in terms of assets, debt and employment, of coal SOEs in Shanxi was evaluated through a survey of annual reports in December 2016. The results are presented in Box 2.

Table 1. Timeline of Shanxi's coal industry reforms

Year	Policy	Coal closure target and implementation
1999	Closure of illegal and unreasonably distributed small coal mines and reduction of coal production	Closure of 2,908 mines and reduction of production by 69.80 million tonnes.
February 2004	Property rights for coal resources	Closure of 4,000 illegal coal mines and shutting down small coal mines with capacity of less than 30,000 tonnes/year
August 2005	Implementation plan for consolidation and compensation of coal resources in Shanxi	Closure of small coal mines by 2010 and improvements in mine safety, reduction of production from small coal mines to 70 per cent of the total.
February 2006	Measures for consolidation of coal mines and coal mining royalties	Closure of coal mines with capacity of less than 90,000 tonnes/ year and those that are illegal, violating safety and environmental standards as well as those near water resources and nature reserves
June 2006	Pilot program on Sustainable Development for the Coal Industry in Shanxi	Consolidation of mines to establish a minimum capacity of 300,000 tonnes/year for existing mines and 600,000 tonnes/year for new mines.
September 2008	Notice on Implementing Coal Industry Reconstruction	By 2010, the total number of coal mines reduced to 1,500; capacity of single coal mines greater than 90,000 tonnes /year; close small coal mines and build large ones and improve safety; construction of 2–3 super large coal groups with capacity of 100 million tonnes/year, 3–5 coal mines with capacity of 50 million tonnes/year; large coal groups produce more than 75 per cent of coal
April 2009	Notice on Accelerating Coal Industry reconstruction	Reduce total number of coal mines to less than 1,000; after consolidation, coal mines larger than 3 million tonnes/year, no less than 90,0000 tonnes/year, and 100 per cent mechanization for coal mining
May 2009	Coal Industry Adjustment and Revival Plan	By 2010 total number of mines reduced to 1,000. Average production of 900,000 tonnes/year for each mine

Source: summarized by authors according various sources

Box 2. Coal SOEs in Shanxi

Following publication of the No. 23 and No. 10 documents on implementing coal industry reform in 2008 and 2009 respectively, mining operations were divided into five geographical areas, each one managed by an SOE (Duan, forthcoming). In addition, two more SOEs, JINGENG Group and the Shanxi Coal IMP. & EXP. Group, were authorized to restructure small coal mines. After the industrial restructuring, Shanxi's coal industry was dominated by these big coal companies (see Table B1), which employed nearly a million workers.

A survey of annual reports and interviews in Shanxi in December 2016 indicated that coal SOE debt has become a problem. Table B1 shows that the average debt-to-assets ratio for the seven SOEs is approximately 82 per cent, and the total debts of the coal groups were equivalent to the total GDP of Shanxi province (Duan, forthcoming).

Table B1. Status of Shanxi's SOE coal groups (December 2016)

Coal Enterprisers	Total Assets (CNY Billion)	Debts (CNY billion)	Coal Production (million tonnes)	Approximate employment
Datong Coal Mine Group	258.04	219.21	180.00	200,000
Shanxi Coking Coal Group	255.70	205.58	105.00	230,000
Shanxi Jincheng Anthracite Mining Group	211.85	175.15	70.42	160,000
Yangquan Coal Industrial (Group)	205.60	176.50	74.33	170,000, retirees 63,000
LU'AN Group	188.32	160.37	86.38	100,000
JINGNENG Group	230.00	180.86	70.36	99,970
Shanxi Coal IMP. & EXP. Group	83.36	70.825	23.17	16,100
Total		**1,188.492**	**680.02/975=69.75%**	**976,070**

Data source: summarized from each company's annual report and website

In December 2016, interview responses suggest that the SOEs such as Yangquan Group and the Fenxi Mining Group had delayed salary payments to their employees. It was reported that, in recent years, employees within the coal companies received only nine months' pay, and some of the companies are struggling to cover the cost of pensions, social security and medical care for retirees. To address the high levels of debt options, bond issuances and the conversion of debt to equity are being considered.

The indebtedness of the sector indicates that the industry has moved into a phase of development where the viability of the sector is in question. Restructuring and industrial transition planning are needed to control losses and phase out assets that are no longer viable.

Simultaneously, increased automation in mines also led to improved safety as well as increased efficiency. However, while automation reduced the number of workers exposed to danger, it also reduced the amount of employment available in the mines and created a general downward trend on employment.

A second consequence of consolidation and automation was increased indebtedness of SOEs, as they borrowed large amounts of money from banks to expand their ownership to new assets and to invest in upgrading technologies, environmental protection and safety facilities. Not only did this investment lead to an increase in debt for the mines, it also created considerable exposure to mining for banks.

In 2013 the coal price fell, plunging the highly indebted coal industry in Shanxi into losses. The SOEs are in a position where default would bring serious financial consequences, given the important role they play in Shanxi society. To avoid defaults, SOEs are reported to have reduced the salaries of workers. Further, the Shanxi government made great efforts to ease the debt issues to assist the SOEs though financial difficulties, including debt restructuring, issuing bonds or increasing credit default swap (SXRB.com, 2016; People.CN, 2016; SINA.com, 2016).

At the national level, there are clear policy signals that the shift away from coal is likely to be permanent. On June 30, 2015, China submitted its Intended Nationally Determined Contribution (INDC), proposing to cut its emissions per unit of GDP by 60–65 per cent by 2030, as compared to 2005 levels. China's INDC also aims to increase non-fossil fuel sources in primary energy consumption to about 20 per cent by the same date. The INDC also states that China "will work hard" to peak its carbon dioxide emissions before 2030. Projections indicate that this transformation will require absolute declines in coal use and production, particularly in the period after 2020 (Climate Action Tracker, 2016). Supporting these targets, the Power Sector 13th FYP, released in November 2016, presents a strategy to deliver the energy system needed to power the broader economic and social development detailed under the main 13th FYP. The plan includes a limit on the capacity of coal-fired generating capacity of 1,100 GW (up from 920 GW at the end of 2016), which will in turn require an end to the permitting of new plants and the cancellation of some projects in construction and development (Greenpeace, 2016).

This policy shift is driven in part by increasing concern over air pollution. A recent report entitled Burden of Disease Attributable to Coal-Burning and Other Major Sources in China estimated that air pollution due to coal use is responsible for 283,000 deaths a year (Institute for Health Metrics and Evaluation, 2016). The severity of this has prompted the government to give priority to addressing air quality and to introduce measures to improve urban air quality (Kitson & Gerasimchuk, 2017). Notably, in Beijing the last coal-burning power station has now been closed (Binglin, 2017). Further progress in improving air quality is dependent on ongoing reductions in coal combustion and a switch to cleaner sources of energy.

Alongside the drive to reduce emissions and air pollution, the broader restructuring of the Chinese economy is a factor prompting a decline in the use of coal. As the rate of economic growth begins to slow and the economy transitions from a high investment and export model to a model built on services and domestic consumption, the demand for new energy infrastructure is also slowing. Since 2013 power generation from coal has started to decline, while power station construction has continued, leading to falling plant utilization and a growing problem of overcapacity. The economic machine that was once credited as building one coal plant a week must now be wound down, as there is simply no need for further increases in generation capacity.

The implementation of national objectives into provincial policy means that Shanxi will have to restrict the development of the coal industry. Development of new coal power plants has been put on hold. On January 15, 2017, the National Energy Administration released the coal-fired generation plan for 2017, placing a moratorium on new coal power projects in Shanxi for the next five years (Reuters, 2017b).

Despite uncertainties for the coal market in the future, there appears to be firm government commitment to reduce coal capacity. Premier Keqiang LI has confirmed this, repeatedly stressing that China's coal capacity that does not meet environmental standards and national regulations must be decisively phased out in favour of advanced capacity (China Government Net, 2016). There is now an opportunity to begin the task of diversifying the economy during a period of relative prosperity.

However, in the rush to resolve the environmental challenges facing China, it is important not to forget the workers and their families that depend on coal for their livelihoods, and the communities and regions that depend on the coal industry for their economic and social strength. International experience shows us that coal industry restructuring has the potential to plunge regions into long-lasting economic downturns leading to poverty, migration, substance abuse and a waste of human

potential. This risk has already been recognized by the Chinese government, which is developing programs to retrain workers and restructure the industry. The challenge of unemployment is significant. Restructuring plans envisage the loss of 5 million to 6 million jobs (Reuters, 2016).

2.2 Case for Reform

The recent downturn in the coal industry has provided a warning to Shanxi on the dangers of over-specialization. The reliance on a single industry makes Shanxi vulnerable to a shift in national energy policy at home and to international coal markets abroad. However, engineering a transition away from an industry that has provided employment and wealth for decades in Shanxi is a difficult concept to sell. There are many stakeholders that would prefer to see policies that reinforce the coal industry and avoid killing the "goose that lays the golden egg." While a more resilient economy is dependent upon the development and implementation of a strategy to develop non-coal industries, the need to diversify is not widely accepted.

Nevertheless, there is a range of factors supporting the case for reform. Notably, the health impacts of the coal-dominated energy system in Shanxi are severe: it was estimated that in 2000, around 2,200 excess deaths could be attributed to particulate matter in Taiyuan alone (Zhang et al., 2010). In response, Shanxi has committed to decreasing PM2.5 by 20 per cent by 2017 compared with 2012 levels. Health impacts from contaminated water and soil are also detrimental to public health.

Resource extraction in Shanxi has caused severe environmental issues and ecological damage. Shanxi has a water shortage, but coal mining exacerbates pressure on water resources; to wash each tonne of coal reportedly requires 4–5 cubic metres of water (Mao, Sheng, & Yang, 2008). Soil contamination in coal mining has reduced land available for farming. Subsidence affects 60 per cent of empty areas, and in some parts of the province, over 90 per cent of underground areas have been mined away, forcing relocation (China Daily, 2016). Research indicates that environmental externalities of coal in China are CNY 260/tonne, of which coal production and coal consumption account for CNY 66/tonne and CNY 166.2/tonne, respectively (NRDC, 2012). Managing affected land and relocating residents away from these regions are a priority for the Shanxi authorities (People's Government of Shanxi Province, 2016a). The environmental impact on Shanxi of coal industry operations could provide a key argument to reform the industry.

The establishment of China's national carbon market in 2017 will be a new challenge to coal companies and could provide a further incentive to reform the coal industry in response to this change. Many companies in other countries have introduced internal carbon prices voluntarily to internalize the economic cost of greenhouse gas emissions. In 2016, over 1,200 companies around the world used an internal price on carbon or planned to do so within the following two years (CDP, 2016). Corporate carbon prices in 2016 ranged from USD 0.3 tonnes of carbon dioxide equivalent (tCO_2e) to USD 893 tCO_2e, with about 80 per cent of the reported prices ranging between USD 5 tCO_2e and USD 50 tCO_2e (Word Bank, 2016). If companies in Shanxi were to adopt such an approach in their management systems, this would further drive a transition to cleaner energy.

2.3 Champions

The dependence of Shanxi province on the coal industry has led to a situation where it is very difficult for policy-makers to imagine a future in which coal is not central within the economy. Due to the centrality and power of the coal industry in the province, many politicians have a background and vested interest in the industry and are sympathetic to its interests.

Many of the proposals and programs developed by the provincial government focus on measures that would strengthen the industry and develop new markets for coal rather than promoting industries

that are not related to coal. A key area that is being explored by the government in Shanxi is the development of industries that manufacture chemicals derived from coal. Improvements in coal production efficiency are also a focus for the government and further consolidation is planned with a goal to improve efficiency. The People's Government of Shanxi is planning to restructure the industry to form coal groups with coal capacity of more than 100 million tonnes/year (People's Government of Shanxi Province, 2016c).

Likewise, SOEs are key players in the social and economic development in Shanxi and are strongly linked to the government. SOEs in Shanxi are in charge of managing pensions and medical bills for all retired staff and registered workers. SOEs will play a key role in creating jobs for former coal industry employees: In China, the terms "reallocation" or "relocation" can be used to describe the transfer to another post within an SOE or even to describe the process of laying off workers and supporting them to find alternative employment (China Daily, 2017). The research conducted in Shanxi as part of this project indicated that in jobless families, a job could be allocated to one member to address poverty. This indicates the blurred lines between the role of the state and the SOE in providing employment and tackling poverty. In some ways, the SOEs are an extension of the state, with social as well as economic goals.[1]

SOEs also have a fundamental role in society through developing agricultural businesses and providing services and resources such as schools, housing, hospitals and other infrastructure necessary for employees and their families. Due to their importance in the economy, and particularly in their role in creating employment, it seems likely that it would not be acceptable to government to see SOEs fail financially. In this case, they can be expected to have significant influence over the political process. Some of these SOEs may be considered "too big to fail." An option would be to separate the social responsibilities from SOEs' operation and reduce the burden on the SOEs. The social responsibilities could be transferred from the SOEs to the government.

Finally, the national and provincial governments have a great deal of control over the operations of the industry. The system of permits to operate and the agreements around the amount of production from each SOE are managed by the government providing control on operations. The consolidation and merging of companies is directed by government mandates. This gives the government a very high level of influence over the industry. In the recent period of low coal prices and oversupply, the government acted to reduce output. There is a risk that government intervention may prevent SOEs from building viable businesses and may lead to calls for subsidies to prop up SOEs that are unable to reform.

2.4 Complementary Policies

The policies required to bring about and manage reform can be divided into three categories: (i) policies that seek to bring about the reduction in size and dominance of the coal industry; (ii) policies that address the social impacts of the transition; (iii) policies that seek to address macroeconomic issues caused by a transition to an economy with a lower dependence on coal. The viability of a decreased role for coal in Shanxi's economic and social structure is dependent upon addressing all three of these areas.

To reduce the size of the coal industry there have been numerous efforts to reduce capacity with a focus on unregulated small private mines; many of these measures are listed in Table 1. These measures have focused on centralizing production in the hands of increasingly large state-owned companies, which has improved efficiency and safety while also increasing government control over the coal industry. In times of over-capacity, government has reduced the operation of coal mines

[1] For more information on coal industry SOEs see Box 1.

by restricting the number of days of operation and in some cases has closed mines. However, the research conducted by IISD in Shanxi indicates that these policies can all be reversed: closed mines can be reopened and temporary limits on production can be raised, for example.

Reduction of capacity and automation have as their consequence the inevitable reduction of the workforce, which has become a very sensitive topic in Shanxi. To address the social impacts of reform, the 13th FYP (2016–2020) included the establishment of a fund to deal with the employment reorganization in coal production areas, including Shanxi. The Industrial Special Fund, created by the Ministry of Finance in May 2016, will distribute CNY 100 billion (USD 14.5 billion) for resettling affected employment in the coal and steel sectors. In 2016, Shanxi received CNY 1.213 billion of the fund (USD 176 million) to subsidize coal companies for managing employment issues resulting from the reduction in coal capacity. In addition, over the next five years, the Shanxi government will spend CNY 2.2 billion (USD 319 million) from the employment funds to support job transfers, retraining, early retirement, and creation of public service jobs and self-employment, ensuring no one would be out of a job (Duan, forthcoming). The plan would imply the need to find new jobs for more than 100,000 workers, posing a challenge to the provincial government to find alternative employment for affected people. The development of a system of social security that channels funds directly to affected former coal miners could help to ease the transition.

The reform also provides opportunities to regenerate former coal mining areas. Policies have been put in place to address environmental and social problems caused by the exploitation of land through coal mining in Shanxi (Department of Land and Resources of Shanxi, 2016). By 2020 the Shanxi government will invest in CNY 30 billion (USD 4.35 billion) to regenerate land in areas that have been affected by subsidence, including resident relocations, infrastructure construction, disaster prevention, environmental recovery and soil remediation, solid waste treatment, and ecological and geological surveys for coal mines. Around 655,000 people are expected to relocate, moving out of 1,352 villages (People's Government of Shanxi Province, 2016a).

To complete a transition away from coal, Shanxi has to develop measures not only to manage the shrinking of the coal industry and mitigate negative impacts of reform, but also to develop a viable macroeconomic model that can deliver jobs and prosperity. Many of the proposed economic development policies in Shanxi are related to the coal industry and may be aimed more at finding new markets for coal rather than a transition away from its production. For example, programs focused on coal chemicals including coal-to-liquid, coal-to-gas and coal-to-oil are becoming an important target for Shanxi. The national 13th FYP for the coal industry also includes plans for developing large modern coal chemical plants. From a social perspective, these technologies could create new jobs, but these programs are still very much related to the coal industry and are likely to bring about further negative environmental impacts while continuing to run counter to national and international trends to move away from coal.

By contrast, and reflecting the projects aimed at environmental remediation in the province, the development of environmental services could be a considerable growth industry for Shanxi. By 2020 the environmental industry is estimated to reach a total value of CNY 2,800 billion, with annual growth of 15 per cent. It is expected that there will be an open market for environmental services, supported by a series of policies and an environmental credit system (Ministry of Environmental Protection, 2016). Shanxi has the market potential for coal mining restoration, soil remediation and ecological restoration in coal and other mining regions. It has already over CNY 140 billion in restoration projects planned until 2030.

The Shanxi government has also issued polices to promote renewable energy, potentially helping to reduce the province's coal dependence. Shanxi's renewable energy consumption has increased from less than 1 per cent of total primary energy in 2010 to 3 per cent in 2015, and the non-fossil fuel energy replaced 5.27 Mt of standard coal equivalent. In the next five years, Shanxi plans to focus on wind, solar, biomass and hydropower to diversify the energy supply system, as well as an increase in the use of coal mine methane. It is expected that by 2020 Shanxi's non-fossil fuel energy will account for 5 per cent of total primary energy consumption (People's Government of Shanxi Province, 2016c).

These projects are linked to poverty reduction. In 2016, Shanxi received a quota from the National Energy Administration to install 700 MWh of solar energy, and the Shanxi government approved 30 projects to implement this quota (Shanxi Development and Reform Commission, 2016). Shanxi's major focus is distributed solar energy for rural and poor regions, as part of their national policy on poverty relief issued by the State Council and the National Energy Administration, with the purpose of improving local people's income. The Shanxi government has invested CNY 200 million (USD 29 million) to subsidize 100 kW distributed solar power stations in 300 villages in the 58 poorest counties (People's Government of Shanxi Province, 2016b). Promoting renewable energies is a very positive step toward reducing demand from coal as a source of electricity, as well as reducing the power exerted by the industry in the province. For grid-connected renewables, and considering the actual overcapacity of coal-generated electricity, it is very important to set clear policies for each generation source, favouring clean technologies to feed electricity into the grid. In the past, policies favouring coal generation have led to the curtailment of renewable generators (Wang, Kitson, Bridle, Gass, & Attwood, 2016). Developing a strong renewable energy industry in Shanxi can also be a source of job creation and economic development.

The promotion of tourism based on the cultural heritage of Shanxi is also under discussion. In 2016, the Chinese government launched an initiative on tourism to relieve poverty in regions with rich natural and cultural resource in more than 1,000 counties across the nation. More than 20 projects in Shanxi were included in this poverty-relief program. These initiatives are important, from the perspectives of attracting new investment, retaining some employment in mining communities and also preserving the community identity and local history of mining communities. Similar schemes have been developed in South Wales and other former coal-producing regions.

The Government of Shanxi is also aiming to increase spending on research and development (R&D) and innovation. In 2015, R&D in Shanxi only accounted for 1.37 per cent of its GDP, lower than that of the national level of 2.07 per cent. The government plans to increase the investment in R&D to 2.5 per cent of local GDP by 2020 (Shanxi Sciences and Technology Bureau, Shanxi Bureau of Statistics, & Shanxi Coal Industrial Bureau, 2017). The government will implement a tax reduction policy to encourage SOEs and private companies to invest in R&D. Promotion of R&D is a key part of a strategy to generate new economic activity.

2.5 Key Findings

Shanxi province is very much dependent on the coal industry. The people depend on the industry for employment; the government depends on the industry to provide a stable economy; and there are strong links between the government and the industry. In this context, there is little appetite for a holistic reform within the province, although there is clear government commitment at the national level to reduce the role of coal in the electricity sector.

In the downturn since 2013, coal capacity has been reported to have fallen (Reuters, 2017a). There is a moratorium on the opening of new capacity and some existing capacity is reported to have closed down. For advocates for a transition away from coal, this all seems to be good news. However, it is reported that much of this capacity has only been temporarily shut down and could easily be reinstated as demand starts to recover. The development of measures to increase exchange of ideas and experiences with other regions that have gone through similar transitions could help to increase knowledge of policy options beyond coal. The Shanxi government should actively use different mechanisms such as the One Belt One Road initiative and other bilateral and multilateral mechanisms to cooperate with international bodies to create forums for wide-ranging discussions on land recovery, ecological restoration, innovation and social policy.

There are some promising signs and some policies that are starting to address the key challenges. Commitments to promote innovation are one measure that can help to develop new industries, but without some strategic direction towards a particular new industry, increased R&D spending could end up further entrenching coal in the economy. Funds to mitigate negative social impacts of unemployment are an essential part of transition; using these funds effectively is a key challenge. Funding for soil remediation and environment regeneration is also an essential part of improving the natural environment and creating the conditions in which other industries can be developed.

Shanxi is not the first to face these issues and many of the solutions being proposed have been tried in other countries. Developing programs to engage with policy-makers and academics from outside Shanxi could help to bring in fresh perspectives and develop a comprehensive strategy for a future that is not so dependent on coal.

3.0 International Experience in Coal Industry Reform and Regeneration

This chapter reviews international experience in coal industry reform and policies designed to address the effects of this reform, in particular the policies that have been put in place to mitigate the social impacts of reform. While the effectiveness and acceptability of policies will vary in line with the local political, economic and cultural context, the experiences presented here can inform debate and highlight factors of relevance to policy-makers in Shanxi and across China.

Policies used to support the closure of coal mines and the transition of the economy away from coal are typically very diverse, as they address different parts of the socioeconomic transformation of the affected regions. Based on the case studies, we identify three main types of policies, listed below. In each case, these policies need to focus on the full range of time frames, from the short to the long term, with institutions being developed accordingly.

1) Strengthen the local economy, including the support of other local industries, innovation, education and entrepreneurship as well as the facilitation of investment into targeted sectors.
2) Improve the physical infrastructure and environment, including transport, housing, telecommunications and the rehabilitation of closed coal mine sites.
3) Revitalize community cohesion and support for economic transformation by reinforcing the local culture and identity and providing the required welfare benefits to avoid a sudden decline in living standards.

The first case study focuses on the policies to promote inward investment and strengthen the economy in The Valleys in South Wales, United Kingdom. It shows that, with new employment opportunities, former coal producing regions can be developed through strategies to attract investment from large employers. However, how to ensure that coal-mining communities in general and coal miners specifically will be able to benefit from the new industries must be considered.

The second case study evaluates social policies in the Asturias area in Spain, which aimed to reduce the social impact of job losses through early retirement schemes. This case concludes that early retirement effectively mitigates short to mid-term hardship but can lead to future problems by reducing incentives to retrain or search for ot\her forms of employment.

The third case study focuses on policies to strengthen the local economy, improve infrastructure and provide public services in the Appalachian region in the United States, through the implementation of a severance tax on the remaining coal production and the allocation of these funds for a range of grants in Kentucky. The case demonstrates the positive effects of diversification on the region overall, but it highlights that a key challenge is to ensure that funds are allocated to deliver real results and that good governance of grant allocation organizations is essential.

3.1 Case Study 1: Economic Development and Inward Investment in South Wales, United Kingdom

CONTEXT

- Coal-dependent region with a history of heavy industry and agriculture
- Mine closure imposed by national government
- Mass unemployment following mine closures

CHAMPIONS / KEY ACTORS

- Conservative government drove mining reform
- Welsh Development Agency had a mandate for regeneration

CASE FOR REFORM

- Unprofitable industry dependent on subsidies
- Shift in political ideology and attitudes to SOEs
- Safety concerns around mines and mining

COMPLEMENTARY POLICIES

- Welfare system reduced poverty
- Policies promoting infrastructure improvements and inwards investment

This case study—which draws upon a longer parallel study (Merrill & Kitson, 2017)—examines efforts to address the social and economic challenges associated with the decline of coal mining in South Wales. In particular, it focuses on the Welsh Development Agency, an agency explicitly charged with overcoming the impact of unemployment arising from the decline of coal mining (as well as agriculture and fishing) in Wales.

3.1.1 Context

Wales, one of the four nations of the United Kingdom, is a semi-autonomous region with a population of approximately 3 million. The South Wales coalfield runs for 90 miles from the east to the west of the region, with an average width of 15 miles. North-South valleys cut through this formation, running down to the coastal strip where the centres of population are concentrated (see Figure 3). The industry developed rapidly with the industrial revolution and continued to grow through the 19th century. Over the course of the 20th century, the fortunes of the industry waxed and waned in response to geo-political factors, expanding during the two World Wars and the post-war construction period, undergoing nationalization under the National Coal Board in the 1940s, but subsequently declining as domestic use of coal fell away due to clean-air legislation and the discovery of North Sea oil. Aside from coal, the economy of Wales included heavy industry: steel, aluminum and tin production; oil processing, manufacturing and agriculture.

Despite a temporary reprieve following the oil crisis of the 1970s and industrial action by miners, the ongoing unprofitability of the industry and the recession of the 1980s led to official recommendations for pit closures. Renewed and intensified industrial action only delayed the program of closures and by the end of the 20th century, coal mining in South Wales had all but disappeared. Between 1981 and 2004, over 27,000 jobs were lost, equating to 97 per cent of coal jobs and 35 per cent of all jobs in the area in 1981 (Beatty, Fothergill, & Powell, 2007).

Figure 3. The South Wales coalfield

Source: Merrill& Kitson, 2017

3.1.2 Case for Reform

The introduction of the Clean Air Act in 1956, the discovery of oil under the North Sea in 1965, and increased imports of cheap coal set the scene for the reform of the coal industry. While the Clean Air Act set the policy conditions for a reduction in the use of coal, the discovery of oil and alternative sources of coal meant that a viable alternative to domestic coal was available. As the energy mix changed, the political power of the coal industry and of miners also began to decline, and in the latter half of the 20th century, economic and political ideologies converged on cutting support to unprofitable industries and stemming the power of unionized labour.

Over the course of the 1950s and 1960s, under both Conservative and Labour administrations, declining demand for coal led to the closure of uneconomic pits and consolidation of resources in fewer and larger pits. Resistance by mine workers was initially muted as jobs were readily available in other sectors, but increased through the 1960s. In the 1970s, pay restraint policies introduced by the conservative government led to large-scale industrial action and to a three-day working week

(National Union of Mineworkers, n.d.). The government was obliged to call a general election to endorse its handling of the strike, which it lost to the Labour Party. From this point onwards, the problem of union power—although present since the early years of the industry—became a central and ideological issue in British politics (Richards, 1996).

While granted a temporary reprieve under the incoming Labour government, by the 1980s, productivity was once more declining and pits increasingly encountering coal seams that were difficult to exploit. The government accepted a Commission report recommending the closure of 27 out of the remaining 33 collieries in South Wales and put an embargo on hiring (Gudgin, 1984). However, in the face of industrial action, the government retreated from confrontation and adopted the gradual approach of withdrawing investment from the mining industry, reducing manpower and relying on economic pressures to close collieries one by one.

A Conservative government returned in 1983 and the National Coal Board launched a determined program of pit closures. In response, the National Union of Miners called a national strike in March 1984. Following some of the most violent industrial action seen in the United Kingdom, the strike collapsed and the ensuing program of colliery closure rapidly ended coal mining in South Wales. By 2003 the United Kingdom had become a net importer of coal.

The drivers for coal industry reform can be seen variously as the result of geopolitical factors, a conflict between ideologies or the impact of economic realities. Nevertheless, the final closure of collieries had a heavy and detrimental impact on the prosperity, health and well-being of those remaining in The Valleys, which Fothergill (2008, p. 3) describes as "one of the most intractable development problems of any older industrial area in the whole of Britain." The impacts on The Valleys called for measures to be taken to attempt to address the immediate hardship of the population and rebuild the economy.

3.1.3 Champions and Key Actors

The roots of the Welsh Development Agency (WDA) lie in proposals for the establishment of a National Enterprise Bureau developed by the Labour government in the early 1970s, which would be tasked with facilitating industrial development. Initially, no specific regional bodies were envisaged, but growing pressure for devolution of economic powers to Scotland and Wales, a pressure given increased force due to the government's dependence on regional political parties, led to a commitment to the creation of development agencies in Scotland and Wales (Eirug, 1983). The WDA was established in 1976 as the government agency tasked to lead the response to industrial decline in Wales, notably in the coal, agriculture and fishing sectors.

The WDA was established with four aims: furthering the economic development of Wales, promoting efficiency and competitiveness, ensuring employment and improving the environment. The aims of the WDA were to be achieved through supporting companies wishing to set up or expand in Wales, specifically by granting loan and equity finance to businesses with long-term futures that could provide stable employment, and by providing subsidized factory space. It provided loans, joint loan and equity investments, and equity purchase amounting to GBP 24.3 million in its first three years.

Between 1976 and 1981, the majority of funds were allocated to the development of industrial sites, premises and infrastructure (73 per cent of funding), followed by land reclamation (17 per cent) and then investment in businesses (10 per cent) (Eirug, 1983). Based in part on these efforts, but also on financial incentives, Wales attracted inward investment of around GBP 7 billion between 1980 and 1995, receiving approximately 15 per cent of the United Kingdom's inward investment and associated jobs; adjusting for population, this is more than three times its proportionate share of the inward

investment (Great Britain Parliament: Welsh Affairs Committee, 2012). The WDA is widely held to be responsible for this success. Between 1983 and 1991 it secured investment totalling over GBP 4 billion, including Sony and Align-Rite (to Bridgend), Bosch (to Cardiff), Hitachi (to Hirwaun), and numerous companies in the automotive components sector—Ford, Toyota Rover, Jaguar, Mercedes and BMW—and in the electronics sector, such as Panasonic (Wales Development Agency, 1991). It attracted the maintenance facilities of British Airways to Cardiff Airport and supported Admiral Insurance plc to locate in Wales. Despite the prevailing economic orthodoxy at this time, which supported free markets over state intervention, the success of the WDA was such that it established an international reputation and garnered support from the range of political parties and trade unions.

In 1992 the Government Public Accounts Committee condemned the WDA chairman and a number of directors for numerous financial irregularities, and relations between the Welsh Assembly and the WDA deteriorated. Nevertheless, the success of the WDA was such that, following the devolution of government powers to Wales in 1999, the newly established Welsh government looked to bring the WDA under its remit. This was finally achieved in 2006 when the WDA was merged with the Welsh Assembly Government. However, since then, Wales has had difficulties in sustaining the level of inward investment, and received just 6 per cent of the total inward investment into the United Kingdom in 2009/10. Part of this reason may have been a drop in the overall level of support to the agency caused by the wider budgeting process; part of this reason may simply have been external economic factors that made other parts of the world more attractive for the light industrial investment that Wales had previously been successful at attracting. Between 1998 and 2008, 171 foreign-owned sites closed in Wales, with the loss of 31,000 jobs, mainly in manufacturing (Great Britain Parliament: Welsh Affairs Committee, 2012). These included Hitachi (left Hirwaun with a loss of 350 jobs), Bosch (left Cardiff with a loss of 900 jobs) and Sony (left Bridgend with a loss of 950 jobs).

3.1.4 Complementary Policies

There has been no long-term overarching and coherent economic and social regeneration strategies put in place for The Valleys. There exists a range of initiatives and policies aimed at supporting former coal mining communities, some of which have had success on a small scale, but few which have been successful on a larger scale.[2] Funding from the EU, while significant, has failed to deliver economic transformation to The Valleys and direct capital and revenue grants provided by the Welsh Assembly Government have also been limited in their impact (Merrill & Kitson, 2017).

Furthermore, although the WDA was initially expected to develop a comprehensive economic and industrial strategy for Wales, a role that would have led to the creation of a broader range of complementary policies, this remit was narrowed due to a direct conflict with the role of the Welsh Office (run by the central government). Eventually the WDA settled into a role akin to a property developer and, subsequently, a promoter and facilitator of investment in Wales. Its focus on this role was clear, and there was little conflict with other agencies and policies—indeed the WDA devised and delivered strategic priorities ensuring that they complemented and did not run counter to any central government policies.

However, inward investment induced by the WDA did not generate the jobs needed in former mining communities (see Section 4.1.4). Thus, the provision of social welfare in the form of unemployment benefits, early retirement and sickness benefits provided a lifeline to the communities while policy-makers sought to reconfigure and revive the local economy. A compulsory national health insurance scheme has existed in Britain since 1911, and it has expanded ever since becoming fully government-funded in 1931 (Thane, 2011). Since then, the welfare system has been transformed many times, and

[2] For example, the Coalfield Generation Trust, which supports small-scale community projects across British coalfields, has been successful in helping to restore community cohesion.

now supplements the income of those without employment, those unable to gain employment, those in low-paid employment, and those incapable of sustaining employment due to illness, injury or other circumstances. Without these measures in place the impacts on the communities would have been even more severe.

3.1.5 Criticism

There have been criticisms directed at the WDA both with respect to its overall performance and its failure to ensure the economic prosperity of the former coal mining regions. The development of a holistic coordinated strategy for economic transformation may have produced better results and reduced the economic and social dislocation associated with the decline of mining.

With respect to overall performance, a parliamentary enquiry into inward investment in Wales concluded that it had largely been attracted by financial incentives, availability of land and competitively priced labour; as competition from Eastern Europe and Asia increased and these advantages were eroded, Wales was unable to maintain its competitiveness (Great Britain Parliament: Welsh Affairs Committee, 2012). Coupled with this, many of the jobs created in the 1980s and the 1990s were low-paid, low-skilled roles and did not improve the long-term skills of employees. Thus, Wales was not seen as an attractive destination for higher-order manufacturing business and for companies operating in the knowledge sector, where high-level skills, innovation and access to knowledge are crucial for success.

With respect to the regeneration of former mining areas, data from 2004 shows that just 5,200 or 19 per cent of the 27,000 jobs lost when the collieries closed had been replaced by alternative employment (Beatty et al., 2007).[3] More recent data (from 2012) shows just 41 jobs per 100 residents of working age, compared to a British average of 67. Social indicators for South Wales are also poor in comparison to other parts of the country, with higher levels of disability claimants, poorer educational outcomes and lower life expectancies than in other parts of the country (Foden, Fothergill, & Gore, 2014).

The spatial aspects of investment security also need to be considered. While the early strategy of building in advance factory units is largely considered to have been instrumental in attracting investment into the region, initially there was concern over under occupancy of factory units, (Morgan, 2002). These units were primarily located outside The Valleys, due to the need to provide good transport infrastructure for incoming businesses, leading to marginal impact on the economic regeneration of the former colliery towns themselves. Similarly, infrastructure projects that were supported by the WDA largely focused on the two primary transport routes between Wales and England—the M4 corridor in the southeast of the country and the A55 route in north—rather than the former mining towns of The Valleys. Accordingly, much of the inward investment attracted into Wales focused not on the former coal mining towns of the Welsh Valleys, but on the centres of population on the coast.

3.1.6 Key Lessons

The WDA is considered to have been successful in attracting inward investment to Wales. Indeed, the decline in investment over the course of the 2000s has been partly attributed to the abolition of the WDA, and there have been frequent calls for its re-instigation. However, its record in ensuring economic development, both in Wales and in particularly in The Valleys, suggests a number of key lessons.

[3] Data refers to male jobs only

Notably, the WDA successfully attracted investment to the country as a whole, though the effect of former mining communities was more limited due to a number of factors. First, the program of infrastructure development implemented by the WDA—notably construction of advance units and upgrading transport links—was successful in providing a base for inward investment, but these investments largely took place outside The Valleys. Subsequently, inward investment also occurred primarily outside of The Valleys, meaning that miners securing one of these jobs had to commute sometimes significant distances from towns often poorly served by public transport or to relocate, thus further eroding community cohesion. Further, the type of jobs created were often not a direct replacement for those jobs lost: miners were regarded as well-paid manual workers and alternative part-time or full time jobs in factories or call centres did not provide equivalent employment in terms of status, skills or salary.

Moreover, the jobs that were created were largely low-skilled roles in the manufacturing sector, based on the advantage of low wages. When this advantage was eroded, the jobs were cut, and Wales found itself unable to compete in a market place that increasingly looked to high-skilled workers. Establishing and sustainable a long-term economic base in former mining communities requires an increase over time of educational and intellectual attainment levels, and here South Wales lags the rest of the country (see above).

Thus, while the experience of the WDA shows that an inward investment policy can certainly create jobs such that the net effect on the economy is positive, care needs to be taken to consider the effects at the level of the community. Further, even where the policy is successful at replacing jobs lost in mining communities, policy-makers need to consider the likely long-term success of inward investment. While policies to cover short-term dislocation are both necessary and appropriate, policies also need to address the longer-term restructuring of the economy.

3.2 Case Study 2: Early Retirement of Miners and Coal Subsidy Reform in Spain

CONTEXT

- Asturias is one of Spain's former mining heartlands
- Coal mining as a main economic and employment sources in the region
- Left-of-centre government at national and regional levels, strongly influenced by worker unions in the region

CHAMPIONS / KEY ACTORS

- The EU and agreements to phase out coal subsidies
- Left-leaning national government aiming to reduce coal subsidies without alienating supporters

CASE FOR REFORM

- Unprofitable industry dependent on subsidies
- EU state aid requirements prompted subsidy phase out

COMPLEMENTARY POLICIES

- Early retirement schemes
- Economic development grants
- Infrastructure investment

This case study analyzes early retirement schemes in the Spanish coal mining industry, focusing on the northern region of Asturias. Coal mining has traditionally been a major source of jobs in the region and the largest and only state-owned coal mining company in the country—Hunosa—is headquartered here.

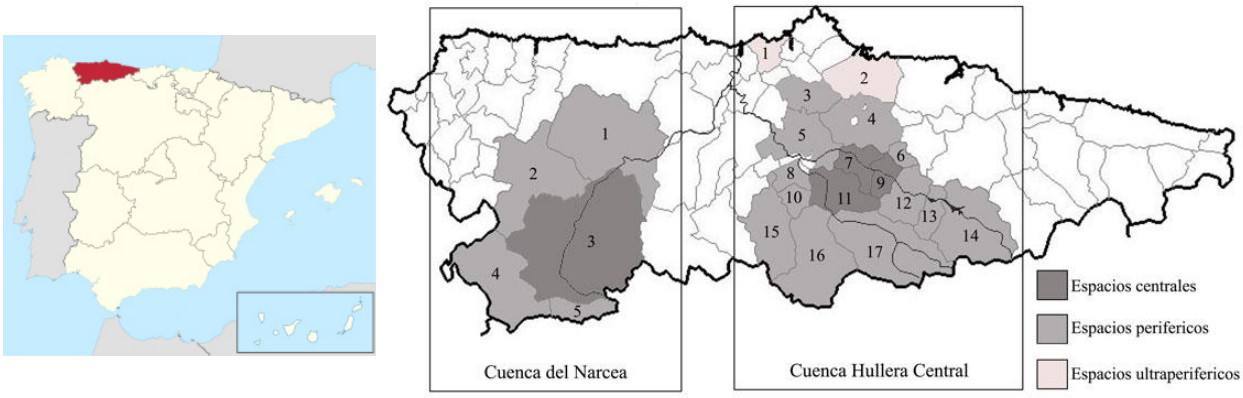


Figure 4. Location of Asturias within Spain and location of coal mines in Asturias

3.2.1 Context

Asturias is a region situated on the north coast of Spain (see Figure 4). In 2016, its population was slightly above 1 million people (1,037,601) and the unemployment rate was 14.6 per cent in the same year (down from 20.3 per cent in 2015) but reaching 47 per cent for men under 25 years old (Datosmacro, 2017). Its economy, traditionally dominated by coal, is now dominated by the services (around 70 per cent of gross value added), followed by industry (around 16 per cent) (Instituto de Desarrollo Economico del Principado de Asturias, 2017). The region's GDP per capita in 2015 was EUR 20.675, ranking 13th among the 19 Spanish regions (Datosmacro, 2015).

Coal mining has a long tradition in Spain. Since the middle of the 20th century, the Spanish coal industry has faced periods of boom and bust. As easily extractible resources have been consumed and other sources have become available internationally, concerns over competiveness have led to calls for government action to maintain viability. This led to a range of subsidies being implemented.

To restructure the industry a series of five reform packages—summarized in Table 2 below—were implemented with the aim of transforming the sector by reducing production and the number of employees. Between 1990 and 2016, total subsidies to the coal industry are estimated to have cost EUR 26 billion, including direct and indirect support to coal mining companies and regions, pre-retirement plans and compensation paid to local coal-consuming electricity generation companies (Sánchez, 2016). In this period, coal production has decreased by 92 per cent, the number of mining companies was reduced by 93 per cent and the number of employees went down by more than 90 per cent to less than 3.000 employees (Figure 5) (Martínez, 2016).

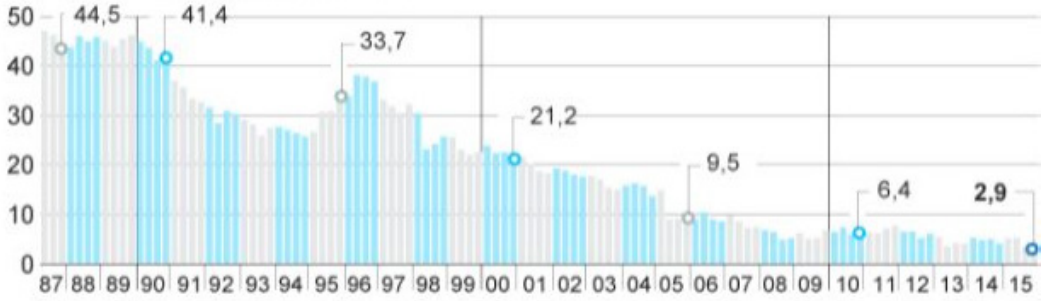


Figure 5. Evolution of workers in the coal mining sector, 1987 to 2015. Data in thousands.

Source: Martínez, 2016

The removal of subsidies and the liberalisation of the Spanish economy at the end of the 20th century was not confined to the coal industry. In 1996 the People's Party (Partido Popular, PP) launched a

program of privatization, tax cuts and the reduction of budget deficits. The phase-out of a publicly owned industry fits within this wider economic narrative (Salmon, 2002).

3.2.2 Case for Reform

A key driver for reform was the entry of Spain into the EU. This move forced the government to comply with state aid rules that require member states to phase out government support that gives a company an advantage over European competitors. To manage the transition, "closure aid" was permitted to mitigate the impacts of mine closures, but only if mines ceased operations by 2018 (European Commission, 2016b).

The cost of maintaining increasingly uncompetitive coal production placed a burden on the government. At the end of the 1980s around 45,000 miners were employed in Asturias, creating a considerable risk that a further deterioration in competitiveness could lead to calls for subsidies to prop up the industry. These factors led to a series of reform packages, presented in Table 2. The policies and measures show that reducing the number of employees via early retirement and voluntary redundancy schemes is a common theme running through these reforms. In implementing these schemes, the government eliminates surplus labour and thus improves competitiveness, while containing the political and social cost of job losses. As Spain entered the EU, Asturias' economy was centred on mining, steel, armaments and shipyards—industries that found it difficult to compete in international markets, leading to industrial decline in several sectors around the same time. Due to the fate of Asturias' industry, early retirement of workers in the region are approximately double the Spanish average, with half of those taking early retirement being former coal industry employees (García-Blanco, 1998; Rodríguez, 2003).

Table 2. Summary of Spain's coal mining restructuring plans

Plan	Leading political party	Change on number of employees	Change on production (tonnes)	Cost (M Eur)	Financed by	Areas of support
Coal Reorganisation Plan 1990 - 1993	PSOE	-6'169	-900'116	4'689	Spanish budget	- Early retirement and voluntary redundancy schemes - Compensations for reduction of coal supplies
Coal Industry Modernisation, Racionalisation, Restructuration and Activity Reduction Plan 1994 - 1997	PSOE	769	427'000	4'275	Spanish budget	- Direct and indirect support to coal mining companies to improve productivity and to compensate supply loses - Early retirement and voluntary redundancy schemes
Coal Mining Plan 1998 -2005	PP	-16'190	-5'675'271	9'246	Spanish budget	- Early retirement and voluntary redundancy schemes - Compensations for reduction of coal supplies
Coal Strategic Reserves National Plan 2006 -2012 and New Model of Sustainable and Holistic Development of Mining Regions	PSOE	-4'910	-5'750'000	4'987	Spanish budget	- Direct and indirect support to coal mining companies to increase productivity - Early retirement and voluntary redundancy schemes - Support to environmental and technological investement projects
Action Framework for Carbon Mining and Mining Regions 2013-2018	PP	-2'222 (planned)	-672'593 (planned)	n/a	Spanish budget	- Direct support to compensate for production losses - Exceptional support including early retirement and voluntary redundancy schemes and mitigation of environmental impact

Sources: cost of plans: (Llamas, 2012); Plan 1998–2005 (Ministerio de Industrial y Energía, 1998); Plan 2006–2012 (Instituto para la Reestructuración de la Minería del Carbón, 2012); Plan 2013-2018 (Instituto para la Reestructuración de la Minería del Carbón, 2013); other: (CCOO & UGT-FITAG, 2015)

The conditions of the early retirement entitlements were formalized via "ordenes" and "decretos,"[4] published by the Spanish government. In general, beneficiaries would receive a salary through the mining company until their legal retirement age, with this age being reduced through the application of reduction coefficients of up to 50 per cent[5] and the pre-retirement salary calculated as a percentage

[4] Spanish legislative instruments

[5] Reduction coefficients are factors applied to reduce the number of years needed to get official retirement. In the case of coal miners, the factor was up to 50 per cent, meaning that each year worked in the sector would count as double for achieving the retirement status.

of their salary in previous years. Early retirement wages were EUR 1,700–2,500 per month (O.M., 2012), around two to three times higher than the national minimum salary of around EUR 764 per month (SEPE, 2016b). Participation was not just limited to miners, but extended across the industry with, for example, engineers and administrative staff also participating (Gonzalez-Camblor, personal communication, 2016; Prieto-Toraño, personal communication, 2016). Libertad Digital (O.M., 2012) indicates that almost half of pre-retirements happen at an age lower than 44.

3.2.3 Champions and Key Actors

The EU has been a key actor in the reform of the coal industry in Spain. The treaty on the functioning of the EU generally prohibits state aid; if member states were to provide support to national industries it could create unfair competition for similar enterprises in other member states. In 2016, the European Commission strengthened its position to phase out coal subsidies. State aid spending of EUR 2.13 billion was approved in Spain to support measures related to the closure of 26 uncompetitive coal mines on the condition that mines cease operation in 2018 (European Commission, 2016a, 2016b). The restrictions on state aid have led a number of European countries to accelerate their plans to phase out coal mining.

The national governments, acting partially out of a need to comply with European obligations and partly on their own initiative, have driven through the reforms. The reforms in Spain were predominantly delivered by the left-wing Spanish Socialist Workers Party (PSOE). The PSOE was in power when three of the five restructuring plans (Table 2) were launched. Coal mining industry reforms were first introduced by the ruling PSOE at the national level, under the presidency of Felipe Gonzalez, as a response to the entry of Spain in the EU. The PSOE was also in power at the regional level in Asturias, winning all elections except for the one in 1995, which brought the opposition party PP (the right-wing Popular party) to power in the region for one term. The presence of the PSOE at regional and national levels during reforms and the party's historical sympathies with unions and the miners led to the implementation of a relatively generous series of measures and a desire to implement a solution that would be acceptable to the generally PSOE voting miners. This is a stark contrast to the situation in Wales (see Case Study 1) where a right-of-centre government adopted a more confrontational approach in an area that traditionally voted for the left-of-centre opposition party.

Workers' unions have traditionally played a very important role in mining regions, especially in Asturias, where CCOO (Comisiones Obreras, the largest and one of the most influential unions in Spain) was founded after a strike at the coal mine La Camocha in 1957 (CCOO, 2014); the Union General de Trabajadores was established in the region by Pablo Iglesias, the same leader that established the PSOE; and the Unión Sindical Obrera, who were the main authors of studies and preliminary documents for the restructuring plans, used their political influence to introduce early retirements as the preferred mitigation measure to reduce the impact of industrial restructuring.

Hunosa, the only state-owned coal mining company in the country, played an important role supporting the reform plans, since it absorbed many of the private coal mines in Asturias that were expected to close due to their high operating costs. Hunosa was created in 1967 from the merger of several private mining companies that were experiencing financial difficulties and that the Spanish government nationalized, transforming them into a single company. Today, Hunosa is owned by the Spanish Society of Industrial Participations, together with other 14 publicly owned companies, and it will continue its activities even after 2018, the end date for coal subsidies agreed with the EU, thanks to its diversification program (Hunosa, n.d.).

The close links between the miners' unions, the PSOE and the national coal mining company Hunosa led to a situation where all parties felt compelled to agree to a deal that would be acceptable to the

miners. Any deal leading to the loss of employment would have to be exceptionally generous to be acceptable so the deal reflected this reality.

3.2.4 Complementary Policies

Aside from early retirement, a number of other measures were used to promote diversification and foster employment in the mining regions. These included grants to set up new businesses, professional training and incentives for R&D and environmental projects, particularly those oriented to improving the operational performance of the coal industry (Table 2). As an example, Hunosa's transformation was based on its expertise in natural resources, starting businesses related to mining consulting services, transforming old mines into museums and expanding into mining related areas, such as the development of geothermal and biomass energies (Hunosa, n.d.).

The plans also supported capacity reductions and the restructuring of coal mining companies, offering financial support that affected the whole logistic chain, including coal transportation and storage. Compensation was also offered to cover technical and social costs of coal mines affected by the reforms. Mining companies that had total costs close to the price of international coal markets got so called "operational support" to close the cost/price gap. The most recent reforms included provisions for the environmental rehabilitation of old mines (CCOO, & UGT-FITAG, 2015).

The plan 2013/2018 included reducing from 15 to 7.5 per cent the maximum share of nationally produced coal in the total primary energy consumption for electricity generation. The 15 per cent cap had been established by the European Parlament directive 2003/54/ CE (CCOO, & UGT-FITAG, 2015). This measure had an important impact on the total coal production.

The transition of former mining regions has been supported by the Spanish central government and coordinated by the regional institutions. Economic development measures include investment in transport infrastructure, such as road building, and the construction of business parks (Gonzalez-Camblor, personal communication, 2016).

3.2.5 Criticism of Reform

Early retirement plans have long been a topic of controversy in local and national media in Spain. The plans have been criticized due to their generosity, the relatively high payouts in comparison to average wages and the young age of the workers who have been awarded early retirement (O.M., 2012). However, the early retirement salaries have allowed former coal industry workers and their families to maintain a standard of living that is well above the poverty line. This has largely shielded local economies from the impact of the reduction in employment as early retirees can still afford to consume local goods and services. Indeed, despite the reduction of the work force, Asturias' GDP per capita in 2015 was at the level of Spain's average, around 20 per cent higher than regions such as Andalucia (Datosmacro, 2015).

If early-retirement plans had not been put in place, workers would have been eligible for Spain's normal system of unemployment benefits, which covers up to two years at 55 per cent of the most recent salary in case of dismissal (SEPE, 2016a). In 1996 coal mining represented 24 per cent of the work force in Asturias (González-Camblor, 2014). Due to the significant layoffs and the relative shortage of employment growth in other sectors, it is likely that many workers would have exceeded the term of standard unemployment benefits. The early retirement plans removed the pressure to find work or face large drops in income.

Early retirements plans were considered on balance to be the best option given the socioeconomic reality of the region, but they also have a number of potentially negative unintended consequences.

- Sociological health of early-retired workers: Without work, levels of alcoholism, depression and divorce have risen (Díaz & Prieto, 2002). The impacts of coal mining unemployment for gender roles and family structures can be profound.
- Important migratory effects: Traditional mining villages like Aller have seen their population reduce by more than 25 per cent between 1996 and 2012 (Fernández-Mateo, 2015), whereas cities like Gijon in Asturias have received an influx of early-retirees (Prieto-Toraño, personal communication, 2016). This happened despite the fact that early retirement was designed to avoid or minimize migrations.
- Reduced incentives to find new employment: High pensions might create barriers to accepting jobs that are worse paid than the early-retirement pensions.

Financial aid for the creation of new companies outside the mining sector has also been subject to criticism in the media. Several articles have reported the closure of companies after the subsidies expired, with the implication that financial support has been wasted (Taibo, 2012). González-Camblor (2014) calls for public institutions to ensure that they control and manage the public money to reduce waste. In practice, innovation requires risk taking. However, the failure of government-backed companies can create public pressure and lead to a reluctance to take risks, driving government support towards established companies that are unlikely to drive transformative change. The story of subsidies bringing investment only for these enterprises to leave as subsidies are removed is similar to the situation in Wales.

3.2.6 Key Lessons

This case shows that early-retirement measures have a number of positive impacts, including the reduction of poverty and the preservation of local economies. A further positive aspect is the predictability of the cost and of the outcome. The breathing space provided by the scheme could also provide time and resources for retraining. To some extent, companies like Hunosa can be considered an example of a government instrument to redistribute wealth (González-Camblor, 2014) and to retrain the work force, as it expands to other related sectors and invests public funds in R&D, for example.

There are several disadvantages to the policy. The primary disadvantage is the cost of the scheme. Paying former miners a monthly salary until they reach the official retirement age is a long-term commitment and can be very costly, particularly if it is offered to younger members of the work force. In addition to this are the unintended consequences, including the tendency towards substance abuse and social breakdown, without the structure and purpose provided by work.

Spain's case also demonstrates that early-retirement plans should be a medium-term measure and should be joined by a set of additional policies to support the early retired and avoid emigration, social exclusion and incentivize jobs creation in the medium and long terms. Well-designed measures to facilitate an economic transformation are needed so that in the longer term the lost jobs can be replaced by new employment.

3.3 Case Study 3: Severance Tax and Economic Development Grants in Kentucky, United States

CONTEXT
- Steady decline of the coal industry
- Unpopular sales taxes in place prior to reform
- Political context allowed a shift away from coal industry

CHAMPIONS / KEY ACTORS
- Federal government
- New governor prepared to take on the coal industry
- Waning influence of coal association
- Non-governmental organizations advocating for change

CASE FOR REFORM
- Dependence of the region on an unprofitable industry
- Need for economic diversification

COMPLEMENTARY POLICIES
- Additional federal-level funding for infrastructure and economic development programs
- Promotion of inwards investment

This case study examines efforts to address the social and economic challenges of coal industry decline in Appalachia with a focus on Kentucky. While the case study focuses on policies implemented in the 1980s, it includes references to policies still in place today. In particular, it focuses on the use of funds from the coal severance tax, a tax placed on coal producers and used ostensibly to fund economic regeneration and diversification initiatives. The tax was put in place originally to allow other unpopular taxes to be removed and to generate funds to diversify the economy away from a permanent dependence on coal.

3.3.1 Context

Appalachia is a cultural region in the United States of America that encompasses the Appalachian mountain range. The region stretches across 420 counties over 13 states and is home to 25 million people (Figure 6). Historically, coal mining and logging provided employment in the region. By 2010 around 80 counties were categorized as "distressed," and 40 of these are located in Kentucky (Appalachian Regional Commission, 2017). This case study will concentrate on this area of Appalachian Kentucky.

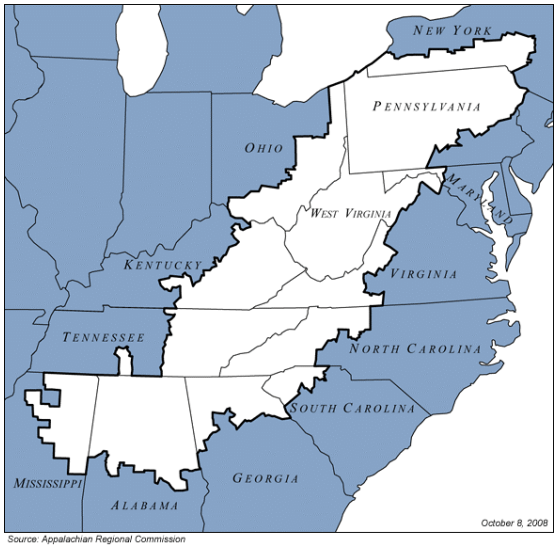


Figure 6. The Appalachian region
Source: Appalachian Regional Commission (2008)

The coal industry has been in decline in Appalachia since 1990. Employment has fallen from a peak of around 125,000 in the mid 1980s to around 60,000 in 1997 (Berger, 2001; Institute for Energy Economics & Financial Analysis, 2015) and around 12,000 in 2014 (Kentucky Energy and Environment Cabinet, 2014). Coal production in Kentucky fell by around 80 per cent between 2000 and 2015 from 125 million

short tonnes in 2000 to 28 million short tonnes in 2015 (Hodge, 2016), just 2 per cent of total U.S. production. The decline has been attributed to softening export markets, competition from cheaper sources and a shift in U.S. consumption towards natural gas for power generation.

Over the last century, Appalachia as a region has been frequently been represented as "lacking integration with the wider economy" and in need of interventions to promote economic development (Billings, 1978). This characterization continues into the present day and the decline of the coal industry is a contemporary driver of this perception.

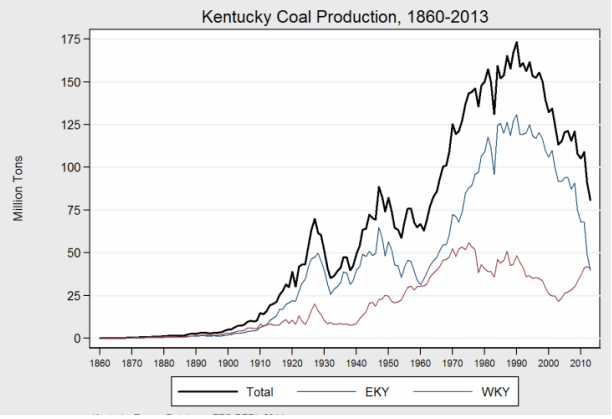


Figure 7. History of coal production in Kentucky

Source: Cates, 2016; Kentucky Energy and Environment Cabinet, 2014

In response to the decline of the coal industry and lagging economic development, various programs and policies have been implemented over the last 50 years. In 1963 President Kennedy formed the Appalachian Regional Commission, to promote economic development. In 1972 Governor of Kentucky Wendell Ford, a Democrat, introduced the coal severance tax, a tax on coal production, initially set at 4 per cent of sales. The introduction of the severance tax funded the abolition of sales tax on food and prescription drugs and various economic development initiatives. The idea behind the measure was that it was seen as a potential source of revenue and could help pay for diversification away from coal in the longer term. The introduction of the coal severance tax was followed by a boom for coal mining as the energy crisis of the 1970s led to high prices and high demand for coal. The coal boom seemed to put paid to concerns that the tax would damage industrial competitiveness in the short term.

Initially, from the scheme's inception in 1972, the funds raised from the severance tax were primarily spent on land or buildings, with 11 regional industrial parks constructed. In the 1980s the Local Government Assistance fund was created following a decision to broaden the range of activities that the severance fund could be spent on. The fund was created with a mandate to invest 30 per cent of the fund under its control in coal road schemes and the remaining 70 per cent on priority schemes in a wide variety of fields, including public safety, environmental protection, social services and industrial development (Collins, 2015). The wide range of eligible project categories provided a significant level of freedom to disperse funds (Bailey, 2013).

Since 1992, severance tax funds have been distributed through the Local Government Economic Development Fund (LGEDF), following concern that the funds were not actually benefiting the coal-producing counties that were most in need of support. The LGEDF distributes funds as grants to coal-producing counties to assist these counties in diversifying their local economies beyond coal production and meet other community development needs. Grants are allocated to many projects including technology incubators, training programs, an entrepreneurship, public service provision and infrastructure investment. Funds are now allocated on the basis of a formula considering mining employment, earnings from mining and unemployment rates (Kentucky Department for Local Government, 2014).

3.3.2 Case for Reform

Coal industry reform was driven partially by economic considerations. First, the perception that the economy in Appalachia has lagged behind other parts of the United State has led to a series of federal

and local plans that have the goal of promoting economic diversification. Second, the gradual decline in coal production and coal mining employment have led to a widespread realization that coal mining will not be the engine of economic growth in the future and therefore policies should seek to manage the decline of the industry while promoting other industries that might replace coal.

The environmental impacts of the coal industry have also been a driver for reform. A report from the Clean Air Task Force ranked Kentucky among the states most affected by coal pollution related health impacts (Clean Air Task Force, 2010). "Moutaintop removal" coal mining practises have linked surface mining to increased cancer rates and public health costs of approximately USD 75 billion per year (Kentuckians For The Commonwealth, 2011). The Empower Kentucky plan, proposed by the advocacy group Kentuckians for the Commonwealth, aims to promote energy efficiency and renewable energy, place a price on carbon emissions to create jobs, and reduce pollution and energy bills (Empower Kentucky, 2015).

3.3.3 Champions and Key Actors

As the architect of the introduction of the coal severance tax in 1972, Democratic Governor of Kentucky Wendell Ford was a champion of coal industry reform in Kentucky. At the time of the introduction of the coal severance tax, the proceeds of the tax were intended to reduce the politically unpopular sales tax paid by ordinary consumers. As a result, and despite a pro-business attitude, Ford was able to assert in his election campaign that he supported the general population to the extent that he was prepared to challenge the favoured position previously afforded to the coal industry.

As might be expected, reform has been generally opposed by the Kentucky Coal Association. They were concerned that the introduction of the severance tax would render the coal industry uncompetitive. Despite the introduction of the tax, the coal industry boomed during the 1970s, in part, due to the global oil crisis (Collins, 2015). Despite declines in production, the coal industry remains a significant employer and as such is an influential player in energy and economic policy; the Kentucky Coal Association remains a vocal opponent of regulation and taxation on the coal industry in Kentucky.

The Appalachian Regional Commission (ARC), a regional economic development agency, was established in 1965 to address the high levels of poverty, low incomes and high unemployment in the region (Appalachian Regional Commission, n.d.a). In 2017 ARC now manages grant schemes under a wider range of program areas and conducts research that shapes economic policy (Appalachian Regional Commission, n.d.b). ARC has a remit to monitor employment and poverty and to develop programs that address these challenges. ARC is influential in the sense that its publications and research highlight the problems that severance tax-funded projects may seek to address. It operates its own grant scheme, which funds similar projects across all 13 Appalachian states. The monitoring and evaluation of these grants mean it has a broad overview of the performance of economic development programs in Appalachia.

Non-governmental organizations also seek to influence economic development policy in Kentucky. Non-governmental research and advocacy organizations include Kentuckians for the Commonwealth, a citizen advocacy group that campaigns on tax and environmental issues related to coal production and was established in 1981. The group has been active on issues relating to the coal severance tax and economic development. Their first "platform" in 1982 called for a modest increase in the coal severance fund. Since then they have continued to advocate for severance funds to be collected and allocated through democratic processes (Kentuckians For The Commonwealth, n.d.). Another advocacy group, the Mountain Association for Community Economic Development, formed in 1976 to promote economic alternatives and improve Appalachian communities. These organizations

continue to scrutinize economic policy and advocate for initiatives that promote economic development in Kentucky. These organizations have been active in shaping reforms to the policy over time through advocacy based on economic analysis of the schemes' performance. For example, these organizations criticized the lack of funds returning to coalfield counties and the focus on the construction of industrial units, which led to a proliferation of units and low occupancy rates. In response, policies were eventually changed to broaden the scope of the funds and allocate more funds explicitly to coalfield communities.

With the decline of coal mining as a major engine of job creation in Kentucky, the balance of power in the state has slowly shifted away from the coal industry. Policy-makers have sought to balance the need for support for economic development in urban areas, where the majority of new jobs have been created, with the needs of coalfield communities that continue to see declines in employment.

3.3.4 Complementary Policies

Aside from the state-level disbursement of funds from the coal severance tax, recent federal-level initiatives, including the RECLAIM Act and the Partnerships for Opportunity and Workforce and Economic Revitalization (POWER) initiative have applied a similar strategy, funding a broad range of infrastructure, public service and economic development projects based on locally identified priorities (Rogers, 2016; U.S. Office of Management and Budget, 2016).

Inward investment incentives have also been used to promote economic activity. For example, as Governor Martha Collings came to power in 1983, unemployment was high and the education system was facing funding shortfalls. Governor Collings aimed to promote education to build a workforce that would be fit for a global economy. In 1985 Collings launched a USD 147 million package of subsidies to secure an USD 800 million investment in a Toyota manufacturing plant employing 3,000 workers. This type of inward investment measure is similar to the policies implemented by the WDA in South Wales.

3.3.5 Criticism of the Reform

A number of key concerns have been raised with Kentucky's policy of collecting a coal severance tax and dispersing this for economic development. The first is that, initially, much of the severance tax was absorbed into general state government funds, to make up for shortfalls due to the abolition of the sales tax, rather than being reallocated to coalfield communities, as some advocates would have preferred. Between 1972 and 1992, USD 2.7 billion was collected. It is reported that only 7.6 per cent has been spent in coalfield counties. In light of these concerns, a conscious effort has been made to increase spending in these counties. Today 35 per cent of total coal severance and processing tax receipts are allocated to the LGEDF, who allocates these funds to coal-producing counties according to a formula.

The second concern is the appropriate scope of the scheme. Over time, the scope of regeneration initiatives has expanded from land and buildings to a diverse range of initiatives from infrastructure and tourism to entrepreneurship and public health. This scope expansion is a double-edged sword. On the one hand, it provides flexible funding that can react to local needs and opportunities; on the other, it causes a lack of specialization and dilutes resources. It is also possible that some projects, such as public health or education projects, may be used to fill gaps in public spending rather than focus on additional activities that drive economic development.

Another issue is how and where best to use public funding. If funding is focussed on economic development, then many of the best opportunities are in urban areas away from the former coal

mining heartlands. Successful projects may create economic activity, but may not benefit the coalfield communities. Indeed, the promise of jobs in other parts of the state may actually accelerate the decline of struggling communities as the brightest and most able leave to seek new opportunities. Alternatively, if the focus is on supporting existing communities through infrastructure upgrades or support for public services, then the short-term needs of the community may be met without solving the longer-term problems relating to a lack of competitive economic activities. In practice, discretionary funding processes seek to balance all economic and social needs over the short and long terms. This challenge is very similar to the debate in South Wales (Case Study 1), where inward investment was promoted in areas outside the coal-producing communities nearer to transport links, creating employment in the broader region but not sustaining communities in the coal-producing towns themselves.

With the risk of funds being used for political purposes and the need to promote state-wide economic growth while preserving the social fabric at the community level, governance of grant allocation organizations is a key challenge. These organizations must have a degree of independence and objectivity to ensure that projects can be fairly evaluated and they must be suitably connected to communities to be in tune with changing needs. Project selection criteria should be clearly defined and subject to public debate and revision.

It is difficult to evaluate whether the economic regeneration policies have led to positive impacts for Kentucky as a whole. In 2015 unemployment finally returned to a prerecession rate of 5.4 per cent. Job growth has been concentrated in more urban areas (89 per cent of job growth occurred in cities), while good road and other infrastructure and employment continues to decline in the traditional coal-producing areas of eastern Kentucky. Migration to urban areas has been driven by these changes (Baumann & Bailey, 2016). Goods-producing jobs, including coal mining, still pay significantly higher wages than service sector jobs in Kentucky. Since 2000, Kentucky has lost almost 90,000 goods-producing jobs and gained 180,000 service-providing jobs. For coal miners or ex coal miners, it is still very difficult to find work that pays has well as mining coal.

3.3.6 Key Lessons

The allocation of a proportion of coal taxes or charges to programs that seek to diversify the economy as a concept has some significant strengths. First, the overdependence on a single industry creates a clear risk for the economy. Second, natural resources are a public good and there are strong arguments that revenues generated by these resources should be used for the public benefit. A diverse economy has clear benefits to the public as it is more likely to provide resilient sources of employment. The problem with this approach is that when the coal industry is doing well, there is less pressure for diversification, and when times are hard there is significant political pressure to reduce taxes and charges on the industry. This highlights the need for resource-dependent regions to "make hay while the sun shines" and diversify their economies.

Economic development is far from an exact science. In some places, a business park may thrive, attracting new innovative companies; in others, similar units can remain vacant. Similarly, grant assistance to public services may facilitate investment and cost savings down the line or may lead to services that are dependent on regular grants beyond their normal sources of funding. Economic development is an inherently local business, and success is bound up with the expectations, abilities and energy of the local communities. To some extent, the approach to the allocation of the severance funds has recognized these challenges and has responded by iteratively reviewing grant allocation procedures. Evaluation of projects is a key tool to identify initiatives that have created positive outcomes and replicate success. However, due to the inexact nature of evaluation, it may be difficult to be sure that reported outcomes are resulting in real change.

4.0 Lessons Learned

> *Now this is not the end. It is not even the beginning of the end. But it is, perhaps, the end of the beginning.*—Winston Churchill

China stands at the beginning of the end of the age of coal. There is an excess of coal capacity and there are sound environmental reasons to reduce the share of coal in the energy mix and ultimately reduce the absolute production and consumption of coal. National policies already reflect this realization, though this is only beginning to filter down to the regional level. Considering that the reduction of coal use is already Chinese government policy, the removal of all wasteful and inefficient subsidies to coal should be a key part of the reform process. Subsidies to coal maintain the industry at a time when a managed decline is called for.

To understand how these changes might affect people's lives, we consider the case of Shanxi (Section 2). The situation in Shanxi has some clear parallels with the case studies discussed in Section 3. Coal is a major provider of jobs that have historically been considered well paying and secure. Now the industry is facing an uncertain future and there is considerable resistance from the coal industry—and many regional politicians to change in the short term. In the longer term, there is acceptance that the development of a diversified economy is a desirable endpoint, but little agreement on when and how this could be achieved.

The case studies present three examples of regions that have faced reductions in output and employment in the coal industry. These transitions were often protracted over decades with periods of extreme upheaval precipitated by crises, such as large shifts in global energy prices. While the process of transition and the impacts on the citizens are determined by the local circumstances, some of the experiences documented may be relevant for policy-makers elsewhere when considering how to design policy responses to transition.

To structure the observations from the case studies, the recommendations will be organized around three policy aims: to strengthen the local economy, improve infrastructure and the environment, and promote community cohesion. A key aspect of the different policies is whether they attempt to resolve the issues created by coal industry transition over the short, medium or long term. A focus on short-term needs can postpone the impacts without improving the underlying situation. Similarly, concentrating on resolving the long-term structural issues risks acute social suffering in the short term.

4.1 Policies that Strengthen the Local Economy

The ultimate long-term solution for the impacts of a transition away from coal is to enable a vibrant economy based on other industries, providing similarly lucrative employment for the population. The case studies show a number of measures that seek to promote the local economy, from measures aimed at promoting inwards investment from large-scale manufacturers in Wales to grants for technology incubators, business parks and start-ups in Kentucky. These investments lead to the creation of employment at a local level, and the companies who are attracted to the area become taxpayers that provide benefits to the wider region.

It tends to be easier to generate new jobs in urban areas away from the communities that have faced direct job losses. This is a double-edged sword. On the one hand, these jobs may increase overall employment and open up opportunities for people willing and able to commute or migrate. On the other hand, measures that encourage the best and the brightest to leave former coal-producing areas risks further undermining the viability of communities. If communities are to avoid terminal

decline, policies should focus on generating employment in the former coal-producing communities themselves, or at the very least on ensuring the continued economic and social viability of these communities through, for example, early retirement policies as adopted in Spain and programs focusing on social cohesion.

New employment opportunities will require a workforce with matching education and skills. Many of those involved in mining are not well equipped to smoothly transition into intellectual or precision industries. Education and retraining will play a key role in promoting the transition from old to new industries and should focus on helping individuals to find a place in the changed economic landscape. For the next generation, education must equip young people for a post-coal future. In South Wales, it was reported that there was a lack of success at retraining former coal miners and that many ended up unemployed or in poorly paid service sector employment. Investment in comprehensive retraining, together with support to transition into other industries, could help to overcome this challenge.

Policies that provide access to capital for other businesses beyond the coal industry can help these companies to expand more quickly, potentially filling some of the gaps left by the reduction in coal production. Grants and loans can also leverage investment and unlock projects that can increase capacity and create jobs. However, it relies on the ability of government institutions to "pick winners." There is a risk that these processes can be distorted to divert funds for political reasons. To avoid this problem, the WDA in South Wales had strict requirements that recipients could demonstrate a favourable return on investment and be capable of providing long-term stable employment in the region.

Over the long term, policies that promote innovation, including funding for entrepreneurship, and incubators for small businesses, can play a role in diversifying the economy. However, these policies are unlikely to directly benefit former coal miners and could take many years to lead to the creation of significant numbers of jobs.

Today in Shanxi there are plans to increase the share of provincial GDP spent on R&D; investments are increasing in renewable energy paving the way for non-coal economic development. However, many of the other economic development policies are directed to coal-related technologies and increased efficiency in the coal sector. Economic development policy in Shanxi remains influenced by the coal industry.

4.2 Policies that Improve Infrastructure and the Environment

Investment in infrastructure is an enabling factor for future economic activity. Industries require access to transport, telecommunications and buildings. In the short term, investment in infrastructure creates immediate employment, thereby directly affecting local incomes, as otherwise unemployed workers receive a salary that is then subsequently spent in the local economy. Infrastructure investment can also offer a platform on which to develop programs aimed at retraining former miners in industries related to construction and renovation. This retraining can in turn increase the human capital of these communities and improve the attractiveness of communities to potential employers.

Over the long term the infrastructure can create the conditions for new economic activities by providing the power, telecommunications, transport and other infrastructure needed for economic development. The success of the WDA in attracting inward investment has been partly attributed to its early policy of building advance factory units as well as to its significant infrastructure projects, particularly in terms of road upgrades. However, if infrastructure does not meet a real need then there is the risk of waste, and the process for predicting the needs is not without risk.

Infrastructure spending plays a dual role reducing immediate social impacts of industry transition while laying the groundwork for future economic development. These two aims may well be in conflict as pressure for immediate action leads to local demands for greater infrastructure spending even if there appears to be little chance of the infrastructure being used for its intended purpose. In the example of Kentucky, a scheme focused on building business parks was reformed after the capacity began to exceed supply by a considerable margin.

Environmental regeneration is a key part of coal industry policy in Shanxi. Tackling the legacy of coal industry environmental impacts and improving the environment will eventually lay the groundwork for economic regeneration. The international case studies show that investment in infrastructure has been a key part of economic regeneration in other regions and could be developed further in Shanxi.

4.3 Policies that Promote Community Cohesion

The role of social factors in helping communities survive through coal industry transitions is not as obvious as some of the other issues discussed here. Yet they are extremely important. Mining jobs have historically provided stability and prosperity for many people, enabling them to construct a social fabric with traditions of solidarity and self-improvement. As the coal industry transition takes effect, unemployment and migration could lead to a breakdown in social relations leading to the rise of social problems, including family breakdown, alcoholism and drug abuse.

Poverty caused by mass unemployment is also a key factor in community cohesion. Welfare programs, such as the early-retirement programs in Spain, provide money to prevent former miners from facing material poverty. In turn, this income spills over into the service sector and helps to prevent a crisis in one industry from turning into a wide-scale economic collapse. Welfare spending effectively buys time during which solutions and alternatives can be developed and implemented. In both Spain and South Wales, welfare systems kicked in to prevent extreme poverty; however, the relatively more generous system of early retirement in Spain limited the economic impacts whereas The Valleys of South Wales have struggled recover since the crises of the 1980s.

However, these social spending programs are not without disadvantages. The provision of funds in the form of welfare programs may address material needs, but it does not provide the sense of purpose that the role of work holds in modern life. People have no desire to live on handouts, but without alternative means to support themselves they may actually find themselves trapped. If out-of-work benefits are generous, it may be extremely difficult to leave them behind to search for new opportunities. Welfare systems must be carefully designed to attempt to anticipate and head off negative consequences.

Unemployment drives mass migration, particularly for the young and well qualified. Migration can lead a loss of social capital and deprive communities of skilled individuals with the potential to generate renewal. Without prospects for regeneration, it is possible that some communities may face a steep decline. Effective policies must seek to keep communities viable, provide for the material needs of the communities and provide for people's needs to retain control over their lives and have prospects for the future.

The problem of unemployment is well understood in Shanxi. Policy responses include government programs that compensate laid-off workers and promote retraining and entrepreneurship. However, the need to develop policies that enact reform while maintaining community cohesion has not necessarily been reflected to date. The case studies showed that unemployment and migration could lead to the breakdown of community structures leading to negative social consequences. Policies should take account not only of the numbers of jobs lost or the cost of welfare programs but also

the impact on community structures and social cohesion. There is a risk that policies, such as those that promote inward investment in nearby towns and cities, could further encourage migration and undermine the social structure in the coal mining communities. In this case, the policy designers must weigh the overall benefit from new jobs, tax receipts and economic activity with the cost of potentially exacerbating social problems in affected communities.

5.0 Conclusion and Policy Recommendations

The situation in Shanxi shares a number of key similarities with the regions of Spain, the United Kingdom and the United States described in this report. The economy is heavily linked to the coal industry and much of the local establishment has a strong interest in continuing to centre the economy on coal production. However, the central government has set a direction based on the gradual reduction of coal in the energy mix due to compelling environmental and economic reasons. A key difference is that reform in the case studies was generally driven by a reduction in competitiveness in coal-producing areas with imported coal or other forms of energy, whereas in China reforms are driven by national concerns about the use of coal and concerted national plans to move away from a reliance on coal-derived energy.

The international case studies indicate that industrial reforms should include measures to strengthen the local economy, improve infrastructure and the environment, and promote community cohesion. The policy response will likely need to include schemes that tackle the short-term need to alleviate poverty through direct payments to former miners in the form of welfare payments or early retirement. In the medium term, job creation schemes through promotion of inward investment from labour-intensive industries and improvements in infrastructure can help to replace lost jobs. Finally, in the long term, support to education and innovation is needed to identify and nurture the industries of tomorrow and provide the workforce for these industries.

This report makes four specific recommendations based on the international experience and the current situation in Shanxi:

1. Establish a comprehensive development plan for Shanxi and other coal-producing regions that analyzes the potential impact of coal industry decline and evaluates possible policies to address economic, environmental and social impacts.
2. Identify new industries – Coal-producing regions should embark on a process to identify new industries that could eventually generate significant employment and focus policies to support these fledgling industries.
3. Make the polluter pay – Consider how environmental taxes and charges could be used to fund the transition. Revenues from carbon-trading schemes, subsidy phase-outs or increased resource taxes could help to accelerate the transition.
4. Stakeholder engagement – An open dialogue with communities, industry associations and other interested parties will help to identify challenges and issues with reform, avoiding more serious consequences.

Shanxi and other coal-producing provinces in China need to work through a difficult transition away from the current status of resource-dependent regions to a diversified economy. The international experience testifies that Shanxi is by far not alone in this situation, and that there is a future after coal.

6.0 References

Appalachian Regional Commission. (n.d.a). ARC history. Retrieved from https://www.arc.gov/about/ARCHistory.asp

Appalachian Regional Commission. (n.d.b). Program areas. Retrieved from https://www.arc.gov/program_areas/index.asp

Appalachian Regional Commission. (2008). Map of the Appalachian region. Retrieved from https://www.arc.gov/appalachian_region/MapofAppalachia.asp

Appalachian Regional Commission. (2017). ARC-designated distressed counties, Fiscal Year 2010. Retrieved from https://www.arc.gov/appalachian_region/arcdesignateddistressedcountiesfiscalyear2010.asp

Bailey, J. (2013). *Investing in a future for Appalachian Kentucky: The coal severance tax*. Retrieved from http://www.kypolicy.us/sites/kcep/files/Coal Severance Presentation.pdf

Baumann, A. & Bailey, J. (2016). *The state of working Kentucky*. Retrieved from http://kypolicy.org/dash/wp-content/uploads/2016/08/State-of-Working-KY-FINAL.pdf

Beatty, C., Fothergill, S., & Powell, R. S. (2007). Twenty years on: Has the economy of the UK coalfields recovered? *Environment and Planning A, 39*(7), 1654–1675. DOI: http://doi.org/10.1068/a38216

Berger, M. (2001). *A study on the current economic impacts of the Appalachian coal industry and its future in the region*. Retrieved from https://www.arc.gov/assets/research_reports/CurrentEconomicImpactsofAppalachianCoalIndustry.pdf

Billings, D. B. (1978). *Economic representations in an American region: What's at stake in Applachia?* Retrieved from http://www3.nd.edu/~econrep/essays/EconomicRepresentations.pdf

Binglin, C. (2017). Beijing shuts down its last coal-fired power plant as part of bid to clear air. *South China Morning Post*. Retrieved from http://www.scmp.com/news/china/society/article/2080270/beijing-shuts-down-its-last-coal-fired-power-plant-part-bid-clear

Bloomberg. (2017). Xi highlights Shanghai, Li's Blue Sky goal: Eye on Chinese media. Retrieved from https://www.bloomberg.com/politics/articles/2017-03-06/xi-highlights-shanghai-li-eyes-blue-skies-eye-on-chinese-media

Cates, K. (2016). Appalachia's coal: Industry troubles started a long time ago. Retrieved from http://ieefa.org/appalachias-coal-industry-troubles-started-a-long-time-ago/

CCOO. (2014). CCOO breve historia. Retrieved from http://www2.ccoo.es/csccoo/Conoce_CCOO:Breve_historia

CCOO & UGT-FITAG. (2015). *La Minería del Carbón y las Comarcas Mineras desde 1986 hasta y despuées del 2019 en España. Breve Análisis, Consecuencias y Propuestas*. Madrid.

CDP. (2016, September 19). Major multinationals at forefront of drive to price carbon and meet climate targets but many companies still unprepared. Retrieved from https://www.cdp.net/en/articles/media/press-release-major-multinationals-at-forefront-of-drive-to-price-carbon-and-meet-climate-targets-but-many-companies-still-unprepared

Chen, J., Liu, G., Kang, Y., Wu, B., Sun, R., Zhou, C., & Wu, D. (2014). Coal utilization in China: Environmental impacts and human health. *Environmental Geochemistry and Health, 36*(4), 735–753. DOI: http://doi.org/10.1007/s10653-013-9592-1

China Daily. (2016). Shanxi manages mining subsidence areas. Retrieved from http://www.chinadaily.com.cn/m/shanxi/2016-07/11/content_26036963.htm

China Daily. (2017). Fund will help relocate workers. Retrieved from http://www.chinadaily.com.cn/china/2016-02/26/content_23647822.htm

China Government Net. (2016, December 22). China will never let outdated capacity squeeze advanced ones. Speech of Primer Li Keqiang. Meeting of the State Council. Retrieved from http://www.gov.cn/xinwen/2016-12/26/content_5153105.htm?_k=v01yhi.

Clean Air Task Force. (2010). The toll from coal: Clean Air Task Force (CATF). Retrieved from http://www.catf.us/resources/publications/view/138

Climate Action Tracker. (2016). China country assessment. Retrieved from http://climateactiontracker.org/countries/china.html

Collins, T. (2015). *Selling the state economic development policy in Kentucky*. Retrieved from http://www.iira.org/wp-content/uploads/2016/11/Selling-The-State-Economic-Development-Policy-in-Kentucky.pdf

Datosmacro. (2015). PIB España per cápita. Retrieved from: http://www.datosmacro.com/pib/espana-comunidades-autonomas.

Datosmacro. (2017). Desempleo de España. Retrieved from: http://www.datosmacro.com/paro/espana

Department of Land Resources of Shanxi Province. (2012). Shanxi's mineral resources planning from 2008 to 2015. Retrieved from http://www.shanxilr.gov.cn/Article/ShowArticle.asp?ArticleID=22717

Díaz, C. & Prieto, B. (2002). *Análisis de la jubilación anticipada en Asturias*. Oviedo: Consejería de Asuntos Sociales del Principado de Asturias.

Duan. (forthcoming).

Eirug, A. (1983). The Welsh development agency. *Geoforum, 14*(4), 375–388. Retrieved from http://doi.org/10.1016/0016-7185(83)90035-0

Empower Kentucky. (2015). Vision and principles. Retrieved from http://www.empowerkentucky.org/plan/vision-and-principles

EU Business. (2010). EU coal mine subsidies to end 2018. Retrieved from http://www.eubusiness.com/news-eu/energy-coal.7kt

European Commission. (2016a). State aid: Commission clears €2.13 billion aid to alleviate social and economic impact of closing 26 uncompetitive coal mines in Spain. Press release. Retrieved from http://europa.eu/rapid/press-release_IP-16-1910_en.htm

European Commission. (2016b). State aid: Commission clears PLN 7.95 billion Polish support for closing coal mines. Retrieved rom http://europa.eu/rapid/press-release_IP-16-3824_en.htm

Fernández-Mateo, I. (2015). *El sector de la minería en España ¿Llega el fin del carbón nacional?* Universidad Pontificia de Comillas.

Foden, M., Fothergill, S., & Gore, T. (2014). *The state of the coalfields: Economic and social conditions in the former mining communities of England, Scotland and Wales*. Retrieved from http://www4.shu.ac.uk/research/cresr/sites/shu.ac.uk/files/state-of-the-coalfields.pdf

Fothergill, S. (2008). The most intractable development region in the UK. In John Osmond (Ed.), *Futures for the heads of the Valleys*. Joseph Rowntree Foundation. Retrieved from http://www.iwa.wales/wp-content/uploads/2016/03/valleys-with-crop-marks.pdf

García-Blanco, J.-M. (1998). Declive económico y políticas regionales: El caso de Asturias. *REIS, 83*, 87–119.

Gerasimchuk, I., Bassi, A. M., Dominguez Ordonez, C., Doukas, A., Merrill, L., & Whitley, S. (2017). *Zombie energy: Climate benefits of ending subsidies to fossil fuel production*. Working paper. Retrieved from http://www.iisd.org/sites/default/files/publications/zombie-energy-climate-benefits-ending-subsidies-fossil-fuel-production.pdf

González-Camblor, M. (2014). *Consecuencias sociales de las jubilaciones anticipadas. El caso de Hunosa*. Universidad de Oviedo.

Great Britain Parliament: Welsh Affairs Committee. (2012). *Inward investment in Wales: Eighth report of session 2010-12*. London: House of Commons.

Greenpeace. (2016). China's power sector 13th Five Year Plan disappoints: Greenpeace. Retrieved from http://www.greenpeace.org/eastasia/press/releases/climate-energy/2016/China-Power-135YP/

Gudgin, G. (1984). Fuelling Britain: The future of coal. *Marxism Today, 28*(6), 30–32. (June), 30–32.

Harris, M., Beck, M., & Gerasimchuk, I. (2015, June). *The end of coal: Ontario's coal phase-out*. Retrieved from https://www.iisd.org/sites/default/files/publications/end-of-coal-ontario-coal-phase-out.pdf

Hodge, D. (2016). *Appalachian coal industry, power generation and supply chain*. Retrieved from http://www.arc.gov/assets/research_reports/CoalIndustryPowerGenerationandSupplyChainReport.pdf

Hunosa. (n.d.). Home page. Retrieved from http://www.hunosa.es

Instituto de Desarrollo Economico del Principado de Asturias, IDEPA (2017). Variables economicas de Asturias. Retrieved from http://www.idepa.es/sites/web/idepaweb/productos/cifras/economia/index.jsp?csection=3&section=3&posl1=2&posl2=3&posl3=-1

Institute for Energy Economics & Financial Analysis. (2015). Appalachia's coal-industry troubles started a long time ago. Retrieved from http://ieefa.org/appalachias-coal-industry-troubles-started-a-long-time-ago/

Institute for Health Metrics and Evaluation. (2016). *The cost of air pollution: Strengthening the economic case for action*. Retrieved from http://documents.worldbank.org/curated/en/781521473177013155/pdf/108141-REVISED-Cost-of-PollutionWebCORRECTEDfile.pdf

Instituto para la Reestructuración de la Minería del Carbón. (2012). *Plan nacional de reserva estrategica de carbon 2006- 2012 y nuevo modelo de desarrollo integral y sostenible de las comarcas mineras*. Retrieved from http://bases.cortesaragon.es/bases/ndocumen.nsf/0/d4c563c07d06a46dc12577a100393312/$FILE/%C3%ADndicePlan_Carbon%202006-2012.pdf

Instituto para la Reestructuración de la Minería del Carbón. (2013). *Marco de actuación para la minería del carbón y las comarcas mineras en el período 2013–2018*. Retrieved from http://www.ugt-fica.org/images/Convenios/mineria/marcomineriadelcarbon.pdf

Kentuckians For The Commonwealth. (n.d.). Home. Retrieved from http://kftc.org

Kentuckians For The Commonwealth. (2011). *Health impacts of mountaintop removal coal mining: Health impacts are harmful & costly*. Factsheet. Retrieved from https://www.kftc.org/sites/default/files/docs/resources/mtrhealthimpactskftcfactsheet.pdf

Kentucky Department for Local Government. (2014). *LGEDF and LGEAF program guidelines*. Retrieved from https://kydlgweb.ky.gov/Documents/Coal/LGEDF and LGEAF Program Guidelines 15-16.pdf

Kentucky Energy and Environment Cabinet. (2014). *Kentucky coal facts 2014*. Retrieved from http://http://energy.ky.gov/Coal%20Facts%20Library/Kentucky%20Coal%20Facts%20-%2014th%20Edition%20(2014).pdf

Kitson, L. & Gerasimchuk, I. (2017). Sticks and toxic carrots: Clearing the air in China and India. Retrieved from https://www.iisd.org/blog/sticks-and-toxic-carrots-clearing-air-china-and-india

Llamas, M. (2012, May). La minería del carbón ha enterrado 24.000 millones del contribuyente. *Libre Mercado*, 1–6.

Mao, Y., Sheng, H., & Yang, F. (2008). *The true cost of coal*. Retrieved from http://www.greenpeace.org/eastasia/PageFiles/301168/the-true-cost-of-coal.pdf

Martínez, V. (2016, March). Los últimos mineros del carbón. *El Mundo*, 1–5.

Merrill, T & Kitson, L. (2017). *The end of coal mining in South Wales: Lessons learned from industrial transformation*. Retrieved from http://www.iisd.org/library/end-coal-mining-south-wales-lessons-learned-industrial-transformation

Ministerio de Industrial y Energía. (1998). *Orden de 18 de febrero de 1998 sobre ayudas destinadas a cubrir cargas excepcionales vinculadas a planes de modernización, reestructuración y racionalización de la actividad de las empresas mineras del carbón*. Retrieved from https://www.irmc.es/el_instituto/Normativa/historico_normativa/common/1998/ORDEN-1998-reestructuracion.pdf

Ministry of Environmental Protection. (2016, September 27). Establish green finance policy framework and promote the improvement of environmental quality. Retrieved from http://english.sepa.gov.cn/Resources/Policies/Policy_Intepretation/201609/t20160927_364739.shtml

Morgan, B. (2002). *The Welsh economy 1975–2001: Transition and renewal*. Welsh Development Agency.

National Union of Mineworkers. (n.d.). History of the NUM: Fall of a government. Retrieved from http://www.num.org.uk/page/History-NumHistory-Fall-Of-A-Government

O.M. (2012, June). La verdad del conflicto minero. *Libertad Digital*, 10–13. Retrieved from http://www.libertaddigital.com/sociedad/2012-06-22/las-claves-del-conflicto-minero-1276462013

People.CN. (2016). Reconstructing loans for the seven big coal groups in Shanxi. Retrieved from http://legal.people.com.cn/n1/2016/0806/c42510-28616149.html

People's Government of Shanxi Province. (2016a). Comprehensive plan for governing coal mining subsidence in Shanxi (2016–2018). Retrieved from http://www.shanxigov.cn/sxszfxxgk/sxsrmzfzcbm/sxszfbgt/flfg_7203/szfgfxwj_7205/201607/t20160704_166290.shtml

People's Government of Shanxi. (2016b, September 13). Notice on the implementation of subsidies to farmers. Retrieved from http://www.shanxigov.cn/xxgk/zfgb/2016nzfgb/d8q/szfwj1/201609/t20160913_248859.shtml

People's Government of Shanxi Province. (2016c). *Shanxi's 13th Five-Year Plan (2016-2020) for Comprehensive Energy Development*. Retrieved from http://www.shanxigov.cn/sxszfxxgk/sxsrmzfzcbm/sxszfbgt/flfg_7203/szfgfxwj_7205/201612/t20161226_272758.shtml

Reuters. (2016). China plans to lay off millions of state workers: Report. Retrieved from http://www.huffingtonpost.com/entry/china-lay-off-workers-curb-pollution_us_56d5e8c0e4b03260bf78453e

Reuters (2017a) China's top coal province to cut 20 mln T of capacity in 2017 – Xinhua. Retrieved from http://www.reuters.com/article/china-coal-shanxi-idUSL4N1F5037

Reuters. (2017b). In latest move, China halts over 100 coal power projects. Retrieved from http://www.reuters.com/article/us-china-coal-idUSKBN151090

Richards, A. J. (1996). *Miners on strike: Class solidarity and division in Britain*. Berg Publications.

Rodríguez, C. (2003). *Las prejubilaciones en la industria asturiana*. Oviedo.

Rogers, H. (2016). Bipartisan RECLAIM Act will release $1 billion in AML funds to support coal communities. Retrieved from http://halrogers.house.gov/news/documentsingle.aspx?DocumentID=398544

Salmon, K. (2002). Spain: From protectionism to advocacy of liberalisation (WP). Retrieved from http://www.realinstitutoelcano.org/wps/portal/rielcano_en/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_in/zonas_in/dt10-2002

Sánchez, C. (2016, June). España se queda sin mineros: El fin de una leyenda. *El Confidencial*, 1–5.

Schwartz, J. (2015). Norway will divest from coal in push against climate change. Retrieved from http://www.nytimes.com/2015/06/06/science/norway-in-push-against-climate-change-will-divest-from-coal.html?_r=0

SEPE. (2016a). Prestaciones Paro.

SEPE. (2016b). Valores salario minimo 2016.

Shanxi Bureau of Statistics. (2016). Shanxi economic development in 2015. Retrieved from http://www.stats-sx.gov.cn/sjjd/sjxx/201601/t20160125_39118.shtml

Shanxi Bureau of Statistics. (2017). Shanxi social and economic development bulletin 2016. Retrieved from http://www.stats-sx.gov.cn/tjsj/tjgb/ndgb/201703/t20170313_80066.shtml

Shanxi Daily Newspaper. (2016). Poverty population consensus and poverty relief program in Shanxi. Retrieved http://www.sx.xinhuanet.com/sjyw/20160528/3170233_c.html

Shanxi Development and Reform Commission. (2016). Shanxi Solar Energy Development Plan in 2016. Retrieved from http://www.sxdrc.gov.cn/xxlm/xny/zhdt/201608/t20160829_175754.htm

Shanxi Sciences and Technology Bureau, Shanxi Bureau of Statistics, Shanxi Coal Industrial Bureau. (2017). Bulletin of Shanxi Investment in Sciences and Technologies in 2015. Retrieved from http://www.stats-sx.gov.cn/tjsj/tjgb/ndgb/201701/t20170104_79163.shtml

SINA.com. (2016, May 19). Financial institutions in Shanxi encouraged to reduce debts for coal companies through debt-to-equity. Retrieved from http://finance.sina.com.cn/chanjing/cyxw/2016-05-19/doc-ifxsktkr5761233.shtml

SXRB.com, (2016< August 2). Shanxi prepares cds for coal companies at provincial level. Retrieved from http://www.sxrb.com/sxxww/xwpd/sx/6277746.shtml

Taibo, A. (2012). Lo que todo el mundo debería saber acerca del conflicto de la minería del carbón en españa. *Desde El Exilio*. Retrieved from http://www.desdeelexilio.com/2012/07/02/lo-que-todo-el-mundo-deberia-saber-acerca-del-conflicto-de-la-mineria-del-carbon-en-espana/

Thane, P. (2011, October). The making of national insurance 1911. *Journal of Poverty and Social Justice, 19*(3), 211–219.

United Nations Framework Convention on Climate Change. (2017). European energy producers commit to no new coal plants after 2020. Retrieved from http://newsroom.unfccc.int/paris-agreement/european-energy-producers-commit-to-no-new-coal-plants-after-2020/

U.S. Office of Management and Budget. (2016). *Investing in coal communities, workers, and technology: The POWER+ Plan. The President's Budget, Fiscal Year 2016*. Retrieved from https://www.whitehouse.gov/sites/default/files/omb/budget/fy2016/assets/fact_sheets/investing-in-coal-communities-workers-and-technology-the-power-plan.pdf

Wales Development Agency. (1992). *Wales: The inward investment story*. Cardiff.

Wang, H., Kitson, L., Bridle, R., Gass, P., & Attwood, C. (2016). *Wind power in China: A cautionary tale*. Retrieved from https://www.iisd.org/sites/default/files/publications/wind-power-in-china-cautionary-tale.pdf

World Bank. (2016). *State and trends of carbon pricing 2016*. Washington, D.C.

Yang, G., Wang, J., Shao, W., & Wang, H. (2015). ScienceDirect: The relationship between China's coal resource development and water resource. *Energy Procedia, 75*, 2548–2555. Retrieved from http://doi.org/10.1016/j.egypro.2015.07.288

Zhang, D., Aunan, K., Martin Seip, H., Larssen, S., Liu, J., & Zhang, D. (2010). The assessment of health damage caused by air pollution and its implication for policy making in Taiyuan, Shanxi, China. *Energy Policy, 38*(1), 491–502. Retrieved from http://doi.org/10.1016/j.enpol.2009.09.039

Published by the International Institute for Sustainable Development.

IISD Head Office

111 Lombard Avenue, Suite 325
Winnipeg, Manitoba
Canada R3B 0T4

Tel: +1 (204) 958-7700
Website: www.iisd.org
Twitter: @IISD_news

Global Subsidies Initiative

International Environment House 2
9 chemin de Balexert, 1219 Châtelaine
Geneva, Switzerland

Tel: +41 22 917-8683
Website: www.iisd.org/gsi
Twitter: @globalsubsidies