

Agulhas

Applied Knowledge

Lessons for a successful transition to a low carbon economy: The five case studies

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1. Spain: Revitalising metropolitan Bilbao

Summary

This case study explores the successful revitalisation of metropolitan Bilbao, a port city in the Basque region of Spain. It looks at how a city on the brink of urban crisis in the early 1980s was revitalised within a generation. Transformation was driven through a government-led Strategic Plan aimed at urban renewal. It has been reported as ‘one of the most successful cases of deep transition’¹ and has become one of the ‘most well known success stories in Europe.’² The employment of a globally renowned architect, Gehry, to develop one of the key elements of the revitalisation programme, the Guggenheim museum, has come to be known as the ‘Bilbao effect – referring to the regenerative effect of a iconic building. Although there are some questioning the stability of this transition, with inequality rising and the inherent instability (and poorly paid jobs) associated with tourism industry, the museum was actually a later development in a much larger regeneration programme that had already been initiated. It is this government-led renewal programme as a whole that we focus on rather than just on the Guggenheim museum’s net positive effect.

Revitalising metropolitan Bilbao

- **Location:** Bilbao, Spain
- **Time period of transition:** 1983 – mid-2000s (approximately 20 years).
- **Scale of transition:** 60,000 manufacturing jobs lost between 1975 and 1995; this saw the proportion of manufacturing jobs drop from 46% to 27%.
- **Sector in transition:** Heavy manufacturing (including steel, shipbuilding and machine engineering).
- **Transition management measures taken:** A ‘Strategic Plan’ was developed by government to revitalise metropolitan Bilbao; this included agreement by the Spanish Government to pay for the costs of relocating industry out of the metropolitan area, a shift towards a knowledge-based, high-tech sector and an early retirement plan for industrial workers aged over 50.

¹ *The New Social Contract: A Just Transition*, Foundation for European Progressive Studies (FEPS) and Change Partnership, 2016, [link](#).

² *Bilbao Ría 2000 – Transformation of Bilbao, Spain through public/private partnerships*, Sustainable Development Knowledge Platform, UN, undated, [link](#).

Context and background

Bilbao is a port city in northern Spain. It is the capital of Vizcaya, one of the three provinces that make up the Autonomous Community of the Basque Country, and has retained its own laws under the traditional Basque legal system until this day. This has given it a distinct identity from the rest of Spain, and allowed it to manage its own revenue base and resources. Bilbao started out as a fishing village that grew into a busy industrial town during the 20th century, renowned for its shipbuilding. The city's strategic location between the Atlantic and Spain, between Europe and the Iberian Peninsula, helped it to grow into an international trading hub.

By the early 1980s, however, Bilbao was a city was on the brink of urban crisis, struggling to recover from the global economic crisis of the 1970s that affected much of Europe and the developed world. It was also facing the breakdown of the steel industry, with factory closures linked to rising petroleum prices and fierce competition from Asian economies. In this context, social and environmental challenges were becoming increasingly apparent, visible in the high levels of physical decay and in air, water and soil pollution. Industrial waste and household sewerage continued to drain into the city's river without being treated until the late 1980s.

In 1983, catastrophic flooding partly submerged much of the Old Town of Bilbao, revealing the true scale of urban decay and highlighting the declining living conditions of the working class population. The flooding provided a much-needed catalyst for change. Strong political leadership aligned behind a clear vision for urban renewal, enabling Bilbao to transition from its 'ugly, dirty and very polluted' image to a modern city. This vision set the path for a complete identity overhaul for Bilbao.

There were, however, some challenges to implementing this vision. The different administrative levels of decision-making in Spain for example, meant that different levels of government were responsible for different parts of the plan. The local government was responsible for urban planning, fiscal power lay with the provincial government and land ownership was overseen by the central government. In 1992, the government created Bilbao Ría 2000, a public company owned in equal shares by the Spanish and Basque governments, to manage large-scale revitalisation of abandoned land. This helped to ensure better government co-ordination and accountability to Basque citizens. Bilbao Ría 2000 bought and redeveloped obsolete land for sale to commercial entities, with all money from sales reinvested back into projects to ensure it became self-financing. The overall aim was to attract local and international investment to the area. The new Zamudio Technology Park, for example, has gradually become more successful, housing over 300 businesses and employing 6,000 people in 2006.

The city's revitalisation has also not stopped. Despite reaching much of its vision for Bilbao by the mid-2000s, the local government has continued to develop and build upon the city's modern new image. In 2010, Bilbao won the Lee Kuan Yew World City prize. More recently, in November 2017, Bilbao was named the Best European City in the 2018 Urbanism Awards, presented in London.

Impacts

Job losses: 60,000 manufacturing jobs lost between 1975 and 1995.³ Industrial jobs declined dramatically as a share of the total, from 48% in 1975, to 28% in 1996, to 22% in 2005.⁴ Shipbuilding alone, for example, lost 42.1% of its jobs between 1982 and 1986.⁵

Unemployment: Overall total unemployment rose from a reported 3% in the early 1970s to 25% by 1985.⁶ Youth unemployment reached 50% in the 1980s.⁷

Violence: The closure of the Euskalduna Shipyard was a deeply traumatic and symbolic process, which resulted in fierce battles between workers and local police in the autumn/ winter of 1984. Clashes ended with the death of one worker and several injured in November 1984.

Population decline: The population of Bilbao decreased from 438,000 in 1980 to 380,000 in 1985 and continued to decline until 1995.⁸ This was linked to a number of factors including boundary changes and a shift towards people seeking more affordable housing outside of the city.⁹ Job losses played a role, however, largely affecting the least skilled and most vulnerable people, many of whom were migrants who returned to their home areas due to no longer being able to find work in Bilbao.

Transition measures taken to mitigate negative impacts

Government measures

Dialogue: In response to the challenges facing Bilbao in the early 1980s, the city council launched public discussions around how best to reshape the city. While some of these discussions were slow to take off, debate was stimulated and ideas began to gradually emerge.

Policy: Local, regional and national leaders responded to the crisis by developing a clear strategy to address fundamental economic and environmental problems in the city. This strategic approach emerged in the late 1980s and a 'Strategic Plan for the Revitalisation of Metropolitan Bilbao' was agreed in 1991. The objectives of the Strategic Plan included inter-city urban renewal, environmental intervention (including river cleaning), strengthening of cultural identity, and development of a knowledge-based, high-tech sector. The Basque government was given the overall responsibility for rebuilding the city. As part of this mandate, the Basque government began to repossess former industrial land and transform it –

³ FEPS and Change Partnership, 2016, *op. cit.* p. 2.

⁴ *ibid.*

⁵ *ibid.*

⁶ *Bilbao City Story*, Power A, London School of Economics, CASE Report 101, May 2016, [link](#).

⁷ *ibid.*

⁸ *ibid.* Note: Bilbao has experienced a smaller and steadier population decline between 2005 (353,173 people) and 2016 (345,122 people), as reported by the Spanish Statistics Office, 2018, [link](#).

⁹ *ibid.*

with the old shipyards as the focal point. Money to do this came from all levels of government and the European Union (EU). The literature indicates that Bilbao's strong sense of its role in Europe and the world played a key part in ensuring institutions and companies worked together in planning the future of the city.

Later on a 'Government Plan 2007-2011' was developed and became an important tool for implementing the political agreement signed by the political groups. It expressed in clear terms the transfer of political objectives (mandated and put forward by the citizens) into specific action plans, with their respective monitoring and control indicators.¹⁰ An incremental approach was also set to implement this ambitious change management plan that took into account principles of good governance including, for example, smart communication (internally and externally) and a clear focus on transparency.¹¹

Management: A dedicated agency, the Bilbao Metropoli-30, was established in 1991 and recognised by the government as a public utility in 1992. Its purpose was to act as facilitator for the regeneration process and to promote the objectives of the Strategic Plan. This agency also fostered cooperation between the public and private sectors in order to identify joint solutions to problems of mutual interest. Its founding members include the Basque government, regional government of Bizkaia and Bilbao City Council, but wider membership includes public and private bodies that exercise their profession or activities within the metropolitan Bilbao area.¹² This creates a sense of joint ownership for success.

A second agency, Bilbao Ría 2000, was also created in 1992 as a public entity, responsible for managing the large-scale revitalisation of abandoned land. De-industrialisation had left 340 hectares of obsolete industrial wastelands in metropolitan Bilbao. Bilbao Ría 2000 is fully owned by the State Administration, the Basque Administration (Basque Government, the Provincial Council of Biskaia and Bilbao and Barakaldo City Councils), the Bilbao Port Authority and the rail company ADIF. All entities involved in Bilbao Ría 2000 have maintained an active commitment that has been a key feature from the outset and has allowed many key projects to be taken forward.¹³ The Mayor of Bilbao in his role as Chair has led this commitment. As Bilbao Ría 2000 also increasingly required the involvement of the private sector, the Bilbao Metropoli 30 facilitated this relationship.

Bilbao Ría 2000 invested €184m up to 2004 in the Abandoibarra area of the city; a prime riverfront area in the city centre.¹⁴ This investment included the development of the Guggenheim Museum designed by American architect Frank Gehry. The Guggenheim was initially opposed by 90% of local inhabitants due to the high initial investment needed but now

¹⁰ *In search of local public management excellence: seven journeys to success*, Bosse et al., EPIA, 2013, [link](#).

¹¹ *ibid.*

¹² *Three Key Organisations: Bilbao Metr opoli-30, Bilbao R a 2000, and the Bilbao Bizkaia Water Consortium*, MAS Context, undated, [link](#).

¹³ *ibid.*

¹⁴ FEPS and Change Partnership, 2016, *op. cit.* p. 2.

attracts over 800,000 external visitors a year (compared with 100,000 before the museum opened) and is seen as a key symbol of Bilbao's transformation.¹⁵ The new international conference centre, the Euskalduna Conference and Events Centre, has also helped Bilbao to develop its business tourism. The centre now attracts over 500,000 participants to hundreds of events every year. In 2013 it held 744 events, was let out at 92% capacity and generated revenue calculated at €78m.¹⁶



Figure 1: Guggenheim Museum, Bilbao¹⁷

Compensation: The Spanish government agreed to pay the costs of relocating industry and paying for the early retirement of industrial workers aged over 50.

Training/ reskilling: Retraining, external marketing, new technology and links between sectors and financial support were all offered as buttresses to vital parts of the economy. Seventy thousand people underwent retraining to develop new skills for new types of work, with a strong focus on technology and environmental business. These strategies were initiated by the city council and part financed by EU funding (see below). As a result, a number of small- and medium-sized enterprises (SMEs) were able to adapt and proliferate within the new climate. New jobs were also created in reclamation, construction, building and restoration.

EU funding: The Basque region qualified for EU 'Objective 2' funding. This provided part of the overall financing for Bilbao's transition. EU Objective 2 funding is a grant-based funding mechanism financed primarily by the European Social Fund (ESF) and the European Regional Development Fund (ERDF). It aims to revitalise areas facing structural difficulties within regions

¹⁵ *ibid.*

¹⁶ Power A, 2016, *op. cit.* p. 4.

¹⁷ Source: [link](#).

where development levels are close to the community average.¹⁸ Areas eligible for Objective 2 funding typically face different types of socio-economic difficulties that often cause high levels of unemployment. In Bilbao's case the structural difficulties being faced included both evolution of the industrial sector and an escalating urban crisis.

EU Objective 2 funding co-finances productive infrastructure, local development initiatives and business activities.¹⁹ In Bilbao it helped to complete the water treatment system, supported building of the first underground metro line and assisted with the conversion of steel furnaces and shipyards to alternative uses. A programme of support was also provided to SMEs, with a focus on innovation and the development of special enterprise centres to house start-ups.

Lessons learnt

Efforts to rebuild Bilbao with a focus on developing a knowledge-based, high-tech sector ultimately resulted in a rise in service sector employment. This rose from 42% in 1974 to 65% in 1995.²⁰ More recent reporting puts this figure at 79.9%, indicating that Bilbao has the highest level of service sector employment in the region.²¹ Overall unemployment rates also dropped from 25% in the 1980s to 20% in 1997, and to 11% by 2004,²² although this has risen again more recently to 18.7%.²³ The overall number of jobs in the metropolitan area grew from 267,000 in 1995 to 380,000 in 2005.²⁴ Employment in hospitality and tourist-related services rose steeply as tourist arrivals increased, partly linked to the business tourism promoted by the Euskalduna Conference and Events Centre and to the new Guggenheim Museum.

A key lesson learnt during the Bilbao transformation was the need for negotiations relating to the closure of capacity or retirement schemes with workers to be led by the national government in accordance with EU law.

A 2016 report by the Foundation for European Progressive Studies (FEPS) and Change Partnership, reflecting on three European transitions including Bilbao, summarised that: *"Once local governments take ownership of the need to transition, they have been able to dramatically redesign local socio-economic models in a timespan of about 20 years."*²⁵ In the Bilbao case, a key to this success was bringing together all levels of government in the project, creating a carefully constructed but functioning balance between different political interests.²⁶

¹⁸ *Objective 2: Revitalising areas facing structural difficulties*, EU, undated, [link](#).

¹⁹ *Objective 2 – Structural Funds*, Welcomeurope, 9 Feb 2012, [link](#).

²⁰ FEPS and Change Partnership, 2016, *op. cit.* p. 2.

²¹ *Municipal Statistics on Active Population 2015*, Eustat, 2016, [link](#).

²² FEPS and Change Partnership, 2016, *op. cit.* p. 2.

²³ *Bilbao*, Eustat, 2018, [link](#).

²⁴ FEPS and Change Partnership, 2016, *op. cit.* p. 2.

²⁵ *ibid.*

²⁶ UN, undated, *op. cit.* p. 2.

Enablers: what worked in the approaches used

Strong political leadership: In the case of Bilbao, a clear and long-term commitment to transition was a key driver of change. Even when initial transformations had taken place, all parties involved continued to work together to ensure the city's transformation remained an ongoing process. Local leaders also took ownership for rejuvenating the region. This leadership was ultimately underpinned by consensus across political parties, various governments and Bilbao Ría 2000.

Sticking to a clear and responsive vision (in some cases despite initial resistance): The government developed a bold vision for the future of Bilbao that attempted to capture new and emerging markets as well as investing in critical enabling infrastructure to benefit future generations. Despite initial resistance to parts of its vision, the government continued to pursue its overarching strategy and eventually won the majority of local people over to the new vision. The Strategic Plan was also constantly adapted in order to allow a dynamic process of change that responded to changes in metropolitan environment. Political leadership has also been important throughout the process. Mayor Josu Ortuondo (in office 1991-1999) played a key role in establishing the Bilbao Metropoli 30, a public-private partnership body that helped to drive forward the government's vision. His successor, and Bilbao's longest serving Mayor, Iñaki Azkuna (in office 1999-2014) also won the World Mayor Prize for his role in transforming industrial Bilbao into a cultural centre.²⁷

Seizing moments of opportunity: The 1983 flooding of Bilbao could have been a final nail in the city's coffin. Bilbao was already facing increasing levels of unemployment, rising urban decay and a number of environmental issues. The government used the flood, however, as a pivotal point for change, demonstrating their ability to turn a crisis into an opportunity.

Strong architectural style: This has built upon an underlying sense of local pride in the region and played a role in bringing government and local inhabitants together around the new vision for Bilbao. Each big development is commissioned by a leading architect to ensure the city builds a vibrant and dynamic image.

Management agencies: Creating management agencies to facilitate implementation of the government's Strategic Plan for Bilbao, and to manage the reclamation and redevelopment of land, encouraged accountability to all stakeholders and allowed a clear division of responsibility between the different stakeholders.

Multipronged approach: A vast array of socio-economic activity was supported under the Strategic Plan. This helped to give the region strength through diverse business models, including, for example, business parks, museums, conference centres and state-of-the-art

²⁷ Iñaki Azkuna, Mayor of Bilbao, Spain awarded the 2012 World Mayor Prize, van Hove T, World Mayor, 2013, [link](#).

transport systems. A wide range of public and private sector stakeholders, facilitated in part by Bilbao Metropoli 30, came together to support development across these different sectors.

Innovative resource mobilisation: This was demonstrated through the ability to obtain resources from upgrading obsolete pieces of land amid the process of industrial dismantling. Much of this land was publically owned and the creation of Bilbao Ría 2000 allowed government authorities to donate this land for free. EU funding was also used to support Bilbao's transformation.

Barriers: obstacles to successful implementation of the measures deployed

One of the main barriers highlighted in the case study material is the initial resistance amongst local inhabitants to change. This was demonstrated during the protests around shipyard closures, with many workers trying to prevent the inevitable closures and loss of jobs. It was also demonstrated when 90% of local inhabitants opposed plans for the new Guggenheim Museum, citing concerns around the amount of public financing being channelled into the project.²⁸ Cultural groups, for example, had their economic assistance and grants cut back as a result of alterations made to cultural allocations to finance the project. The local government were called 'fools' for accepting what nobody else wanted and for embracing American imperialism.²⁹ During this time, the public view very much conflicted with the government view, which was that the new museum would become the symbol of the city and incorporate Bilbao into the international art circuit.³⁰ The success of the museum eventually transformed the adverse opinions of local inhabitants but it took the government standing firm and remaining committed to its vision.

Literature reviewed

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²⁸ FEPS and Change Partnership, 2016, *op. cit.* p. 2.

²⁹ *Bilbao's Strategic Evolution: The Metamorphosis of the Industrial City*, MAS Context, Issue 30-31, undated, [link](#).

³⁰ *ibid.*

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2. North East England: Fostering entrepreneurship in the low-carbon economy

Summary

This case study explores specific interventions that took place in North East England within the higher education sector to address the challenges associated with high unemployment following a transition from the steel and chemicals sector. Specific attention is paid to a project put in place by a regional development agency called ONE (One North East) to look at how to develop entrepreneurship and the links between universities and industry in the Tees Valley. ONE was established as the entity to distribute government aid to support the region's regeneration. It was located on the former site of two coal-fired power stations which had been iconic source of jobs, energy and local identity.

The higher education initiative resulted in the development of specialist centres of excellence since the early 2000s. This case study looks at how a range of different funding was utilised to stimulate the growth of enterprise in a region in which unemployment had been higher than the UK average by 5-7% (1999-2000).³¹ It is based on the impact assessment³² that was performed by ONE during its operation along with economic reports and Eurostat data for the region which shows the resulting positive legacy of the initial intervention. The ONE fund was part of a series of interventions in the region that ultimately led to a transition of the region from one dominated by coal and heavy industry to its current position as a 'clean tech hub' – with a biomass plant, electric car design and manufacture (the Nissan Leaf collaboration with Newcastle University School of Engineering and the manufacturing plant in Sunderland), carbon capture technology, and an offshore wind and renewables enterprise zone. The River Tyne, once dominated by coal production and distribution, is now the location of an ecosystem of low-carbon technology innovation, design and manufacture.

³¹ Eurostat Database, [link](#).

³² *University Enterprise Evaluation*, Final Report for ONE North-East, KSA, 2009, p. 15.



Figure 2: 100% electric Nissan Leaf³³

Fostering entrepreneurship in North East England

- **Location:** North East England
- **Time period of transition:** 1971 – mid-2004 (approximately 30 years)
- **Scale of transition:** Between 1971 and 2004, over 93,000 manufacturing jobs were lost from the area principally due to the rationalisation of the steel industry in the UK,³⁴ and following the decline of the coal industry.
- **Sector in transition:** Heavy manufacturing including steel, chemicals and engineering.
- **Pre-existing infrastructure:** Using the infrastructure available from five universities in the north east (Newcastle, Northumbria, Durham, Teesside, Sunderland).³⁵
- **Transition management measures taken:** Transition measures for education investment were taken after the transition had taken place, in reaction to the regional decline. Measures included:
 - the development of hubs for new businesses to develop and access support;
 - raising awareness of entrepreneurship and capacity building;

³³ Source: [link](#).

³⁴ *Tees Valley Economic Assessment*, Tees Valley Unlimited, 2013.

³⁵ KSA, 2009, op. cit. p. 11.

- building networks and centralising innovation and entrepreneurship within dedicated university centres/departments.

Context and background

The Tees Valley is located in North East England, covering an area of 304 square miles and with a population of around 660,000 people. It is made up of five local authorities – Darlington, Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton.³⁶ The Tees Valley has moved from a heavy manufacturing base in the 1970s towards an economy today that is based on information and communications technology (ICT), creative media and advanced manufacturing.

Historically, employment in the Tees Valley was based on a small number of large employers including ICI and British Steel (employing over 40,000 employees each in the late 60s/70s).³⁷ Over 93,000 manufacturing jobs were lost through mass redundancies as a result of the decline of the steel and chemical industries in the UK.³⁸ Creating social challenges for the region as a whole in relation to unemployment and associated informal habits of the population described by Hudson (2005) and Coen (2005)³⁹ as “*low expectations and limited ambitions as regards education and skills acquisition*”.

Coen (2005) also reported that the “*underrepresentation of innovative small- and medium-sized enterprises (SMEs) and business start-ups*” etc. had created challenges with linking innovation and knowledge networks.

The focus of this case study relates to interventions on innovation as part of a regional programme of development in the mid-2000s. The main drivers for the intervention were to increase the development of micro and small businesses in the region and to address the “*failures across the north east universities to establish ‘enterprise’ within their core mission statements*”.⁴⁰ This mission is in some respects linked, and also to challenge to the societal norms suggested in both Coen (2005) and Hudson (2005).

ONE invested more than £3.25m to help the five main universities in the north east build capacity in ‘entrepreneurship’ and enterprise commercialisation. Two of the universities are located in the Tees Valley (Teesside and Durham) and three are located within the north east generally (Sunderland, Newcastle and Northumbria).

The overall aims of the programme were:

³⁶ Location, Tees Valley Combined Authority, [link](#). [accessed 22/05/2018]

³⁷ Tees Valley Unlimited, 2013, *op.cit.* p. 12.

³⁸ *ibid.*

³⁹ *The role of universities in the regional innovation systems of the North East of England and Scania, Sweden: providing missing links?* Coen, 2007, Environment and Planning C: Government and Policy 2007, vol. 25, pp. 803-821.

⁴⁰ KSA, 2009, *op. cit.* p. 11.

- The provision of support for students and university teams to develop business skills.
- Supporting micro businesses directly, raising awareness of entrepreneurship.
- Encouraging and supporting graduates to remain in the region.

Utilising existing infrastructure: The programme discussed here built on earlier successes associated with the creation of different centres of excellence in the region – Life Sciences, Process Innovation, and New and Renewable Energy – and innovation connectors including Newcastle Science City, DigitalCity (Teesside), Sunderland Software City, Design Centre for the North and NETPark. It is also important to stress that the Tees Valley regeneration has continued, with the 2017 economic impact study for the area stating that job creation has and is continuing.⁴¹

Note: the project built on funding for other projects that had been accessed across the universities up to four years before the start of ONE's investment examples given include Northern Rock foundation, Higher Education Innovation Funding, Higher Education Active Community Fund, etc.⁴²

Impacts and context

Job losses: 93,000 manufacturing jobs lost between 1971 and 2004.⁴³ With just over half of the jobs in British Steel (from 40,000 to 19,000) and half of the jobs in the chemical industry (from 40,000 to 20,000) lost by the early 1980s.

Low levels of enterprise, and research and development (R&D): Levels of spending on R&D per person in 1999 were 37% of the spend average in the UK, with increases from the mid-2000s onwards towards 50%. Note these figures are to provide context rather than to suggest a causal link between industrial decline and R&D spend.

Unemployment: Overall total unemployment decreased from high levels in the early 1990s (13.6% in 1993) to less than 6% in 2017;⁴⁴ however, the area still has issues with unemployment and growth. A 2016 report by Martin *et al.* suggests that both the legacy of an industrial past along with the structure of the economy may lead to lower levels of growth.⁴⁵ In addition, issues such as transport, geography and reliance on central government were also mentioned as barriers to growth for industrialised areas.

⁴¹ *ibid.*

⁴² *ibid.*

⁴³ Tees Valley Unlimited, 2013, *op.cit.* p. 12.

⁴⁴ Note: there have been fluctuations especially during the financial crisis.

⁴⁵ *Divergent cities in post-industrial Britain*, part of the Government Foresight series on: *The Future of Cities*, Martin *et al.*, 2016, [link](#).

Poverty: Although the percentage of core poor⁴⁴ has decreased since the 1970s (from 14.5% to 12.7% in the 2000s), the Tees Valley has consistently had a higher percentage of ‘core poor’ than the UK in the last four decades (the difference was at its highest in the 1980s and 1990s).⁴⁶ Note: research that shows the causal link between industrial decline and poverty was not found during the literature review undertaken for this project, but the statistics provide the context and point to the need for enterprise in the region.

Transition measures taken in relation to fostering innovation in higher education

A summary of actions and specific targets set out for both Durham and Teesside are shown in Table 1 followed by a detailed description of each of the actions taken and lessons learnt.⁴⁷

Note: This was one programme amongst many.

Table 1: Summary of actions and targets

University	Starting point	Summary actions	Targets	Results
Durham	Active in the North-East Centre for Scientific Enterprise and an emphasis on enterprise learning through the business school	Enterprise strategy development (update) Coordinate current approach to enterprise (raising awareness of students and staff, increased capacity staff and students’ higher levels of entrepreneurship amongst new graduates) ONE investment of £568,950	Jobs (33) Businesses created (30) Businesses surviving first 12 months (7), 24 months (7) Businesses supported (30) Skills development (25) Leverage £390,464	Jobs (39) Businesses created (24) Businesses surviving first 12 months (-), 24 months (3) Businesses supported (22) Skills (197)* Leverage £137,375
Teesside	Established a graduate incubator with an investment of £28m Support networks and enterprise strategy in place	Develop activities under the strategy Support direct training, mentoring and support to commercialise research (capacity building & integration of exiting work within the university, higher levels of entrepreneurship amongst new graduates)	Job (54) Businesses created (44) Businesses surviving first 12 months (19), 24 months (no target) Businesses supported (no target) Skills development	Jobs (54) Businesses created (44) Businesses surviving first 12 months (23), 24 months (no target) Businesses supported (82) Skills development

⁴⁶ Note the data show that the % of core poor increased from the 1980s to 1990s for the UK and Tees Valley. “Core poor: defined theoretically according to Bradshaw’s (1972a, 1972b, 1994) Taxonomy of Need as people suffering from a combination of Normative, Felt, and Comparative poverty, that is, people who are simultaneously income poor, necessities/deprivation poor and subjectively poor (see Bradshaw and Finch, 2003)”.
Poverty, wealth and place in Britain, 1968 to 2005, Joseph Rowntree foundation, 2007.

⁴⁷ A combination of data from different tables (4, 6, 9 & 10) in *University Enterprise Evaluation*, Final Report for ONE North-East, KSA, 2009.

University	Starting point	Summary actions	Targets	Results
		Raise awareness of enterprise (students and staff) ONE investment of £670,000	(120) Leverage of £649,000	(327)* Leverage of £649,000

* Skills interventions were significantly higher than target for all universities i.e. courses.

Detailed higher education measures

Establishing hatchery and incubation facilities:⁴⁸ To support higher levels of entrepreneurship and the commercialisation of research, Teesside established hatchery and incubation facilities along with an enterprise development fund to support academic enterprise; for example:

- delivering high quality premises and support for graduate start-ups along with support for social enterprise and linking to a network of specialists
- increased capacity of central and academic school support teams to enable the commercialisation of innovation
- promotion of high-growth business creation through targeted investment based on areas of expertise within the university

Similarly, in Durham an incubator unit was established for pre-start and early businesses with varying levels of membership and access to support services. Durham also supported graduates to start businesses within the creative centre as part of the 'Creative Gleam Programme'. The programme included the delivery of workshops on areas such as idea generation and validation, mentoring to support new ventures, networking and stakeholder management, to developing your customers and a business case. In addition, the programme was supported by many different stakeholders of importance for the creative sector e.g. the Arts Council, Northern Cultural Skills Partnership, NCC, Ouseburn Trust and local businesses.

Networks, knowledge transfer:⁴⁹ Durham University established a new centre which included an enterprise and knowledge transfer directorate as part of its work to 'share knowledge'. The development of a Centre for Entrepreneurial Learning, separate to the business school, took place to ensure that the cross-cutting nature of entrepreneurship was recognised in the university. The centre's objectives focus on ensuring its work had an international dimension and profile, supporting and working with students and academics, and working with external experts to bring entrepreneurial businesses into the university to make the experiences 'real'. Funding was obtained both from ONE and other sources e.g. Higher Education Innovation Fund (HEIF) funding to cover core costs for 4-5 years.

⁴⁸ Summary of work included in *University Enterprise Evaluation*, Final Report for ONE North-East, KSA, 2009.

⁴⁹ *ibid.*

Training and raising awareness: This was a focus for Teesside who developed an enterprise development programme for students, graduates and staff. This was further supported through the curriculum and mentorship. The programme was marketed and promoted to increase demand and raise awareness.

Lessons learnt

ONE invested more than £3.25m to help the five main universities in North East England build capacity in 'entrepreneurship' and enterprise commercialisation. The results of two of the investments were that both Durham and Teesside met or exceeded their targets of direct job creation and supporting businesses, with Teesside also meeting its target for business creation. Teesside exceeded its targets in relation to business support and businesses surviving for 12 months while Durham did not quite meet these.

Key lessons learnt were that the funding provided by ONE resulted in leverage of £2.9m in other funds across the five universities that were supported. The additional investment was obtained from the HEIF over a three-year period. Both Durham and Teesside Universities achieved the targets set out for the leverage of funds. The HEIF is described as "*providing funding for knowledge exchange*" and is administered by the Higher Education Funding Council for England (HEFCE).⁵⁰

Note: Allocations for HEIF funding are performance-based. "*Institutions are eligible to receive an allocation if they exceed a £250,000 threshold related to their external income earnings and performance of the sector overall.*" This eligibility criteria helps demonstrate the importance of the initial investments made by ONE and the access to additional funds that this initial investment facilitated.

In addition to the key findings relating to funding and strategy, the impact assessment stated that the provision of funds has also helped with university infrastructure and the establishment of partnerships external to each university. There was also a sense that the enterprise agenda has been taken up by the universities involved in the programme, ensuring that this forms part of their mission and core strategy. The establishment of partnerships and networks external to the universities helped engage local support.

The main issues with the approach taken include:

- That lack of funding both for core and non-core activities can curtail progress, thus the sustainability for some of the activities is threatened by the need to rely on grant-based funding.

⁵⁰ Higher Education Funding Council for England website, [link](#). [accessed 22/05/2018]

- The universities each took different approaches to delivering the enterprise programme (e.g. focus on business engagement, vocational courses etc., depending on university strategy) with varying results. This mirrors findings in other literature that state regional and cultural norms impact how successful programmes relating to enterprise can be.
- There are further findings particularly in relation to the longevity of start-ups and the reliance on specific individuals to contribute to success. This means that planning an exact outcome in relation to the development of an enterprise programme is not straightforward and will be influenced by a number of cultural human factors (e.g. reliance on specific individuals, attitudes to enterprise etc.) that cannot be controlled.

Enablers: what worked in the approaches used

Flexibility: The impact assessment stressed that a flexible approach to the use of funding allowed each university to focus on the development of enterprise programmes that would work in their local context. It allowed for different starting points, i.e. different levels of initial commitment to enterprise and to ensure that the measures taken were focused on areas that were important to each university such as awareness raising in the case of Teesside and aligning and centralising approaches in Durham.

Asking universities to think strategically and put enterprise at the heart of their work: The requirement for each university to ensure that enterprise was addressed as part of their core mission and strategy has meant that the programme helped to develop university infrastructure relating to enterprise, e.g. capacity and facilities to support the development of businesses and the commercialisation of research.

Engaging with stakeholders, networks and partnership: Although varying across the programmes, the development of academic networks was stated as *“having added legitimacy to the ‘enterprise’ activities of universities.”*

Barriers: obstacles to successful implementation of the measures deployed

The main barriers and some recommendations provided by the impact assessment for the programme include:

- The need to take a regional view of the development of enterprise, specifically considering where activities relating to the development of enterprise skills can add to the regional economy. There is also an acknowledgement that there were still issues with the engagement of academics in the process and that funding for activities is difficult to secure.
- Although the impact assessment recommends the continuation of activities and funding, it is also worth noting that the situation in the Tees Valley has changed. ONE

no longer exists as a development agency so funding for activities must be secured separately by each university for their enterprise programmes. It has also been difficult to establish (other than where specific targets have existed) which developments in the regions in general can be attributed to this programme solely.

- The programmes developed here did not coincide with a specific transition period, rather they were developed in the aftermath of transition as a result of low enterprise and business development seen in the region. It has not been possible to make direct causal links between the general state of the economy, research, levels of poverty in the area and the move from an industrial past towards a more knowledge-based economy directly.

Future development

North East England has, since this funding (2002-2006), continued to develop enterprise in the region in different ways. In the current economic plan for the Tees Valley region, the local government wishes to provide a supportive business environment for start-ups (in terms of investment and access to services and advice) with a focus on the knowledge and circular economy.⁵¹ Furthermore, the plan suggests the targeting of support for foreign direct investment in SMEs with high growth potential (specifically focusing on key sectors e.g. chemicals, health innovation, energy and advanced manufacturing). The Strategic Plan builds on both the initial work by ONE but also the development of centres of excellence that were already in place such as DigitalCity in Teesside, which is also part of Teesside University. Here, the links between the university and business have been further established since the original programme described in this case study took place. Teesside University has also made it to the short list of the NCEE's Entrepreneurial University of the Year in both 2014-2015 and 2010-2011.⁵²

Despite the progress made, the region overall still faces challenges with the unemployment rate in the north east still 8% higher than in the UK.⁵³ That said, the latest economic report for the region showcases inward investments made in advanced manufacturing such as "Nifco's £23 million investment in new plant and premises supplying Nissan, Jaguar Land Rover and other key automotive companies" along with the encouragement of new and emerging sectors in the field of digital business citing support through DigitalCity.⁵⁴

⁵¹ *What is circular economy?* Ellen MacArthur Foundation, [link](#). [accessed 22/05/2018]

⁵² *Entrepreneurial University of the Year (2009-2017)*, NCEE website, [link](#).

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3. China: Heavy industry to high-tech transition in Shenyang City (沈阳)

Summary

Shenyang is a city with over 7 million inhabitants and the capital of Liaoning Province, located in the northeast of China. Heavy industries dominate the area and the central Chinese government is looking to transition these industries towards cleaner industries, as articulated in the 2015 policy 'Made in China 2025'. Central government provides some funds to help the transition of workers from classic industrial work environments into new forms of employment. This case study focuses on how the Shenyang municipal government and regional initiatives tackle the transition goals towards cleaner industries, especially the job losses.

Note: The flaw in this case study is the lack of reliable unemployment statistics for Shenyang and Liaoning Province; official unemployment data is unreliable. It is, therefore, hard to assess which and how transition measures impacted the laid-off heavy industry workforce.

Transition of the coal industry in Shenyang

- **Location:** Shenyang, capital of Liaoning Province, northeast China
- **Time period of transition:** Two distinct periods:
 - c. 1998 – 2003;
 - 2015 – present
- **Scale of transition:** Nationally 700,000 of 2.8m workers in state-owned coal mining companies laid off between late 1990s and early 2000s,⁵⁵ 3.2m expected to be laid off 2015-2018 (no reliable unemployment data available for Shenyang heavy industry)
- **Sector in transition:** Heavy manufacturing industry, coal mining, heat and power from coal
- **Transition management measures taken:** The central government policy of 'Made in China 2025' prompted the local government to set up a ¥50m (\$7.8m; £5.8m) fund in 2015, to establish a private high-tech industry. National measures to enable the transition away from heavy industry include an early retirement and retraining fund worth ¥100bn (\$15.6bn; £11.7bn).⁵⁶

⁵⁵ *Managing the political economy frictions of closing coal in China*, Caldecott, Bouveret, Dericks, Kruitwagen, Tulloch & Liao, Smith School of Enterprise and the Environment - Sustainable Finance Programme Discussion Paper, 2017.

⁵⁶ Currency conversions from xe.com, [link](#). [accessed 21/05/2018]

Context and background

General political context

Since the mid-1990s, China is working to create a socialist market economy. This means that state-owned enterprises (SOEs) that lost money were given less government support and forced to compete. Only since the socialist market economy introduction, SOEs were allowed to go bankrupt and close. At the same time, rural enterprises started to compete more directly with SOEs. The socialist market economy brought about an influx of foreign capital and a shift towards private enterprises in China.

Past employment background

The introduction of the socialist market economy in the late 90s led to high levels of unemployment due to the closing down of SOEs, leading to a wave of layoffs until approximately 2003. Official figures report fairly low figures of 4-5% unemployment. Surveys conducted put the real figures at the 20% mark for the period.⁵⁷

It is also estimated that a quarter of the 2.8m total workers in state-owned coal mining companies were laid off between the late 1990s and the early 2000s.⁵⁸ The geographical distribution of laid-off coal mine workers was heavily concentrated in the 'rust belt' of northeast China (Heilongjiang, Jilin, and Liaoning provinces). These layoffs deprived many workers of what used to be secure and relatively well-paid jobs, and created a large new group of urban poor. It is believed that those laid-off workers were also the most vulnerable and least able to find re-employment.⁵⁹

Current national emissions and employment background

China has set the target of covering 20% of its energy consumption with non-fossil fuel sources by 2030. Energy generation from coal will be specially impacted by achieving this target. In 2015, coal accounted for 73% of energy generated and 66% of energy consumed. The coal industry also was one of China's largest employers;⁶⁰ in 2015, mining and processing accounted for 5.8m people, with 3m of those working for power and heat utilities. At the same time as setting the most ambitious renewables goal globally, China is the biggest emitter of carbon emission in the world. Consumption of fossil fuels accounts for 90% of the country's carbon emissions, 68% of which from burning coal.⁶¹

⁵⁷ *China comes full circle with talk of mass lay-offs*, Hornby, Financial Times online, 2016, [link](#). [accessed 12 December 2017, subscription required]

⁵⁸ Caldecott *et al.*, 2017, *op. cit.* p. 21.

⁵⁹ *ibid.*

⁶⁰ *ibid.*

⁶¹ *ibid.*

Liaoning Province context

The Chinese economic slowdown from 2012 to 2016 led to a reduction in emissions during this period. In 2014-2015 approximately 1.4m coal and steel workers lost their jobs across China.⁶² The economy in Liaoning Province also suffered, despite official Beijing figures not reflecting this at the time. The economic performance figures for the province were later revised by the central government.⁶³ Since 2016, emissions increased significantly across the country and Beijing shut down a large number of steel mills and polluting factories – this was unprecedented.⁶⁴ Since 2016 until the end of 2018, it is estimated that across China, a further 1.8m coal and steel workers will be made redundant.⁶⁵ Despite the unprecedented shutdown of polluting factories, this number of redundancies is the continuation of an already existing trend.⁶⁶ In Liaoning Province, over 40 coal mines have closed since 2015, while steel manufacturing capacity has reduced by over 13m tonnes.⁶⁷

Although small in comparison to other provinces, the coal industry is powerful in Liaoning Province. Beijing gave permits for (highly polluting) coal conversion plants, then followed these permits with the switch of some of the national power generation capacity from coal to gas made from coal.⁶⁸ This indicates that the power of the central government over the conduct of the coal industry and heavy industry in Liaoning Province is, perhaps, less absolute than over industry located nearer the capital. It seems that the central government does not wish to see a replication the late 2015 protests in Hefei, capital of Anhui Province. Hundreds of Maanshan Iron and Steel workers protested in Hefei, after the plant was closed and 4,800 people were laid off.⁶⁹ Across China, larger companies and SOEs have been avoiding layoffs because local authorities are worried about social stability.⁷⁰ Instead, these companies reduced wages and hours.

Shenyang context

Shenyang was negatively impacted by the war in the early 20th century; the war period was, however, also the reason for the city expansion beyond the old city walls. Supporting the military and accelerating economic development, Tiexi District (铁西区) became the new industrial centre of Shenyang, and one of the most significant heavy industry areas in China. Tiexi District has been experiencing a de-industrialization process since 2002.⁷¹ In the late

⁶² *What To Make Of Industrial Layoffs*, Cui, Gavekal Dragonomics Ideas, 2016, [link](#). [accessed 4 January 2018; subscription required]

⁶³ *China recovery pushes greenhouse emissions to global record*, Buck & Hornby, Financial Times online, 2017, [link](#). [accessed 15 December 2017; subscription required]

⁶⁴ *ibid.*

⁶⁵ *China's laid-off workers pose daunting welfare challenge*, Feng, Financial Times online, 2017, [link](#). [accessed 12 December 2017; subscription required]

⁶⁶ Cui, 2016, *op. cit.* p. 23.

⁶⁷ *Shenyang, a City of Successful Transition from China's Industrial Pioneer to Innovative Manufacturer*, Shenyang Municipal Bureau of News, 29 December 2016, [link](#). [accessed 23/05/2018]

⁶⁸ Buck & Hornby, 2017, *op. cit.* p. 23.

⁶⁹ Feng, 2017, *op. cit.* p. 23.

⁷⁰ Cui, 2016, *op. cit.* p. 23.

⁷¹ *Emerging Identity: Envisioning Eco-cultural Infrastructure in Post Industrial Shenyang, China*, Gao S, Master Thesis, submitted to the University of Washington, 2017, [link](#).

1990s, many of the SOEs in the Shenyang went bankrupt, and millions of workers lost their jobs. Goa (2017) recalled, “I remember the district our family used to live in being called ‘Tiexi Vacation Village’ because no one had a job at that time. ... the workers refused to leave because of their sense of responsibility and their deep attachment to the place.”⁷² In the early 2000s, remaining inner-city factories were relocated to more rural areas.

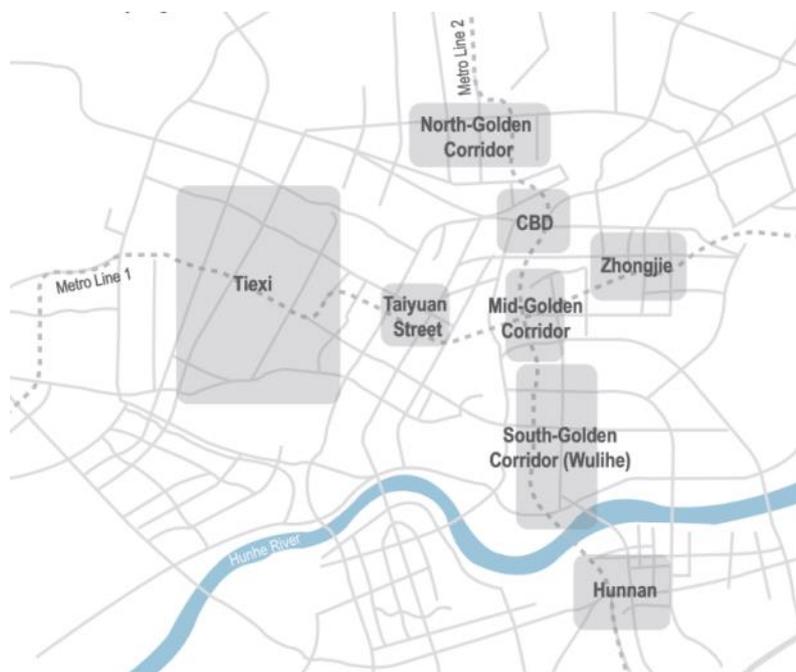


Figure 3: Industrial districts of Shenyang in 2016⁷³

De-industrialisation in the early 2000s and relocating the old industrial district did not significantly improve environmental pollution. The air pollution levels in Shenyang are still dramatic. For example, in November 2015, visibility was less than 100 metres due to particle pollution. Particulate Matter 2.5 (inhalable particles with diameters that are 2.5 micrometres or smaller) exceeded 50 times the concentration deemed as not harmful.⁷⁴

As of 2014, the three industries in Shenyang with the highest industrial output (in CNY) were equipment manufacturing, car and car parts manufacturing, and construction materials manufacturing. Construction and manufacturing accounted for over 40% of all people employed in the city according to official data.⁷⁵

⁷² *ibid.*

⁷³ *ibid.*

⁷⁴ *Der Smog der armen Leute*, Handelsblatt online, 2017, [link](#). [accessed 23/05/2018]

⁷⁵ *Shenyang City Profile*, Research Report, LaSalle J L, 2016, [link](#).

Impacts

Job losses: Official statistics are hard to come by, and when available are deemed highly unreliable.^{76,77} Officially, Shenyang had an unemployment rate of 3% in 2013.⁷⁸

Communities: Industry workers from the traditional heavy industries formed strong communities in Shenyang before the economic crisis in the late 1990s. This woman remembers her childhood in the tight-knit community fondly; her father was a heavy industry engineer in manufacturing in Shenyang: *“Our family used to live in an industrial campus together with hundreds of young engineers and workers. Before the campus was relocated (in the early 2000s), it carried a lot of unique childhood memories of mine back to the old days. Even now, I can still remember the central courtyard, where we kids used to play and laugh under the magnolia blossoms in spring; eat ice cream together in summer; watch leaves falling in autumn; and have snowball fights in winter.”*⁷⁹

These communities were destroyed when SOEs went bankrupt, forcing the communities to move to the outskirts of Shenyang to find new employment.

Earning capacity: Moving affected the earning capacity of laid-off workers looking for new employment. Economic decision-making in China is substantially based upon guanxi (social relationships). By moving to a new city and even within a large city such as Shenyang, workers may be cut off from many of their existing social relationships. This is likely to impact their employability and attractiveness for pay-rises and promotion. And the pay cuts were significant – a survey of 55 businesses in 2001 showed that laid-off workers were only paid 20-30% as much as workers who remained within their company.⁸⁰

Transition measures taken to mitigate negative impacts

Policy: In 2015, China started to implement a policy to transform traditional heavy industries – ‘Made in China 2025’, an industrial roadmap to make factory automation a national economic priority. At the same time, another 2015 policy called ‘Internet Plus’ has been pushing the manufacturing industry to adapt to the information economy. The Shenyang local government bills itself as example of a successful transition process to implement these policies for improving the economic development of China.⁸¹ The local government has designated the Shenyang Economic Development Area (SEDA) in the west of the city, with focus on

⁷⁶ Caldecott *et al.*, 2017, *op. cit.* p. 21.

⁷⁷ Buck & Hornby, 2017, *op. cit.* p. 23.

⁷⁸ LaSalle J L, 2016, *op. cit.* p. 24.

⁷⁹ Gao S, 2017, *op. cit.* p. 23.

⁸⁰ Caldecott *et al.*, 2017, *op. cit.* p. 21.

⁸¹ Shenyang Municipal Bureau of News, 2016, *op. cit.* p. 23.

developing the area as a new industrial city centre since heavy industry factories began moving out of Tiexi District in 2002.⁸²

Fostering high-tech industries: The local Shenyang government has established a ¥50m (\$7.9m; £5.8m) fund dedicated to fostering the development of private high-tech industries.⁸³ For example, the local government established the Sino-German Intelligent Equipment Manufacturing Industrial Park in Tiexi District.⁸⁴ This industrial park serves the municipal government target to attract foreign companies who want to establish their enterprises close to their Chinese customers.⁸⁵ At present, a specific goal is to attract more research-based German companies to the industrial park. To support this, planned are a Sino-German R&D Centre, new infrastructure and amenities such as a smart communications system, a smart power grid, an international hospital, school and community.⁸⁶



Figure 4: Sino-German Industrial Park in Tiexi District, Shenyang⁸⁷

Capitalizing on the robot revolution: In 2015, China had only 49 robots per 10,000 manufacturing workers according to the International Federation of Robotics (IFR). This compared with 531 in South Korea, 305 in Japan, 301 in Germany and 176 in the United

⁸² LaSalle J L, 2016, *op. cit.* p. 24.

⁸³ Shenyang Municipal Bureau of News, 2016, *op. cit.* p. 23.

⁸⁴ *Shenyang: A Home for German Companies*, Shenyang Municipal Bureau of News, 29 December 2016, [link](#). [accessed 23/05/2018]

⁸⁵ LaSalle J L, 2016, *op. cit.* p. 24.

⁸⁶ *ibid.*

⁸⁷ Source: [link](#).

States.⁸⁸ Chinese car manufacturing factories were less than a third as automated as plants in the US and Japan. Beijing, however, has set a goal of raising the ratio of industrial robots to 100 per 10,000 manufacturing workers by 2020.⁸⁹ Rather than making workers redundant in Shenyang, robot manufacture is creating jobs: Shenyang's Siasun Robot & Automation already has developed a variety of robots for use in car manufacturing factories. In December 2016, more than 70% of robots sold in China were foreign made;⁹⁰ Shenyang is an early nationwide contender to reduce this percentage.

International and national infrastructure development: The Sino-German Industrial Park in Tiexi District was approved as a national pilot project by the Chinese State Council in 2015. Over 50 German companies have since settled in Tiexi District, including BMW, Festo, Siemens and BASF.⁹¹ A direct train line connects Tiexi District with the German city of Duisburg in the Ruhr Valley (oft cited as a key example of a successful coal transition, for example IDDRI/Climate Strategies studies on coal transitions), with one train running per week. BMW uses the connection to ship automotive parts to Shenyang. The Shenyang municipal government sees this example of infrastructure as advantageous for Tiexi District: *"The 48 sq km (12 km x 4 km) area with ideal infrastructure is an internationally competitive location for high-end technologies."*⁹²

To strengthen the all-important connection to the capital, Shenyang will also be connected to Beijing through a high-speed rail line, due to be completed in 2019.⁹³ Going forward, within SEDA, a total land area of 30 sq km is planned for the development of a China-France Eco-City. This project aims to build up a local industry for green technologies in equipment manufacturing.⁹⁴

Retraining and early retirement: China has set aside ¥100bn (\$15.7bn; £11.7bn) to fund labour retraining efforts and early retirement programmes to ease the burden of capacity cuts.⁹⁵ This is not sufficient though, mainly due to the early retirement age paying state pensions from age 55 to women and from age 60 to men. In 2013, the national pension system had a surplus of ¥60bn (\$9.4bn; £7bn). Just two years later in 2015, this surplus was a deficit of ¥180bn (\$28bn; £21bn). If national retirement and employment is conducted without changes, China will be liable to pay retired workers a total of \$122tn by 2050.⁹⁶ However, the budgeted ¥100bn fund is supposed to go primarily to help the 1.8m workers in coal and steel expected to lose their jobs from 2016 until the end of 2018.⁹⁷ That works out to

⁸⁸ *Only One Winner In The Global Robot War*, Chandler, Gavekal Dragonomics Technology, 2016, [link](#). [accessed 04/01/2018; subscription required]

⁸⁹ *ibid.*

⁹⁰ *ibid.*

⁹¹ Shenyang Municipal Bureau of News, 2016, *op. cit.* p. 26.

⁹² *ibid.*

⁹³ LaSalle J L, 2016, *op. cit.* p. 24.

⁹⁴ *ibid.*

⁹⁵ Cui, 2016, *op. cit.* p. 23.

⁹⁶ Feng, 2017, *op. cit.* p. 23.

⁹⁷ *ibid.*

¥55,000 per worker, assuming that no money gets lost in the bureaucracy on its way to the workers.

Employment in the public sector: In addition to labour retraining efforts and early retirement programmes, the ¥100bn government fund will subsidize new public-sector jobs. Like the other strategies, this was also done in the late 1990s. These subsidized jobs will likely expire in a couple of years when the public funds run out. The laid-off industrial workers are themselves more likely to see these jobs as a temporary source of income rather than a new career, a face saving arrangement to deliver what are really welfare payments. Working in a coal mine or steel mill is a high-status job, and few of these workers will be enthusiastic about staying in a low-status notional public service position. So it is quite likely that workers shed from the coal and steel sectors will end up migrating in search of better jobs.⁹⁸

Lessons learnt

China is unique in its institutional set-up. Revitalising Shenyang after the first wave of layoffs in the 1990s only started in earnest after 2010. The launch of the central government policy of 'Made in China 2025' kick-started SEDA, located in the previous heavy industry Tiexi District. The industrial park replaced heavy industries with higher value-added manufacturing and service businesses as a new source of economic growth and employment opportunities. Targeted national and international infrastructure has already succeeded in making Shenyang a manufacturing hub for high-tech industries.

Shenyang is on track to grow economically, with a strong path forged to establish cleaner industries.⁹⁹ It is, currently, hard to judge the number of layoffs in the heavy industries since 2015, or how the economic incentives of the municipal government to establish high-tech industries in Shenyang has impacted the laid-off workforce.

Enablers: what worked in the approaches used

Revitalising a redundant industry area: The Tiexi District was not used after SOEs closed down in the late 1990s and the remaining heavy industry left from 2002 onwards. Building on existing infrastructure in the area, the local government managed to quickly establish the area as a high-tech manufacturing area.

Significant funds: The ¥50m (\$7.9m; 5.8m) local government fund established in 2015 clearly aided the desired establishment of private high-tech industries in SEDA. The fund enables the local government to allow tax breaks to companies in the range of 25% to 15%. In addition, companies that qualify to obtain high-tech-status also receive a 200,000 yuan (\$31,400; £23,390) bonus.

⁹⁸ *ibid.*

⁹⁹ LaSalle J L, 2016, *op. cit.* p. 24.

Parallel projects: The municipal government has established SEDA in the Tiexi District and is looking to diversify investment, both from sectors and countries. For example, BMW from Germany and Michelin from the US are located in different areas of the city, with a different set of infrastructure offered.

Barriers: obstacles to successful implementation of the measures deployed

Retraining challenges: Due to the attractive early retirement option, most eligible workers choose to leave the workforce if they are in the correct age bracket. In addition, heavy industry workers that are laid off tend to be older than 40,¹⁰⁰ making retraining also harder because these workers have only known manual labour in the heavy industry for many years.

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¹⁰⁰ Feng, 2017, *op. cit.* p. 23.

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4. Germany: Lignite mining to tourism in Lausitz

Summary

The Lausitz is the second largest lignite (brown coal) mining area in Germany. Located in the former East Germany, the region underwent a rapid transition following German reunification. A package of short-term transition measures was deployed to address the loss of 70,000 jobs in the region over just ten years, which was successful. The lack of the introduction of long-term measures from the start, however, has led to longer-term negative impacts of the job losses.

Transition away from coal in the Lausitz region

- **Location:** Germany, partly covering the previous East Länder of Brandenburg and Sachsen
- **Time period of transition:** 1990 – 2000
- **Scale of transition:** 90% of jobs lost within 10 years: from 80,000 in 1990 down to 20,000 in 1995, down to 7,000 in 2000.
- **Sector in transition:** Coal mining, heat and power from coal, associated industries
- **Transition management measures taken:** Creation of a new decontamination organisation in 1991 that supplied 20,000 short-term jobs; early retirement; reskilling and establishing a new key industry. Former open-cast mines filled with water to create 'lakeland'; and a former conveyor bridge, wastewater treatment plant and viewing tower all preserved as monuments of the region's industrial heritage, with tours of the still operational open-cut mines.

Context and background

The Lausitz region (English: Lusatia), located in former East Germany, is the second largest lignite/brown/soft coal resource region in Germany, with about 1 million inhabitants.¹⁰¹ In 2014, 61.8 Million Tonnes (MT) of coal were mined and the three coal power stations generated 6.7 gigawatts (GW). About 2,000 people were employed the coal power stations in 2013,¹⁰² with employee numbers fairly evenly distributed according to electricity generated. In total, the lignite industry in the Lausitz employs about 15,000 people, with half of those

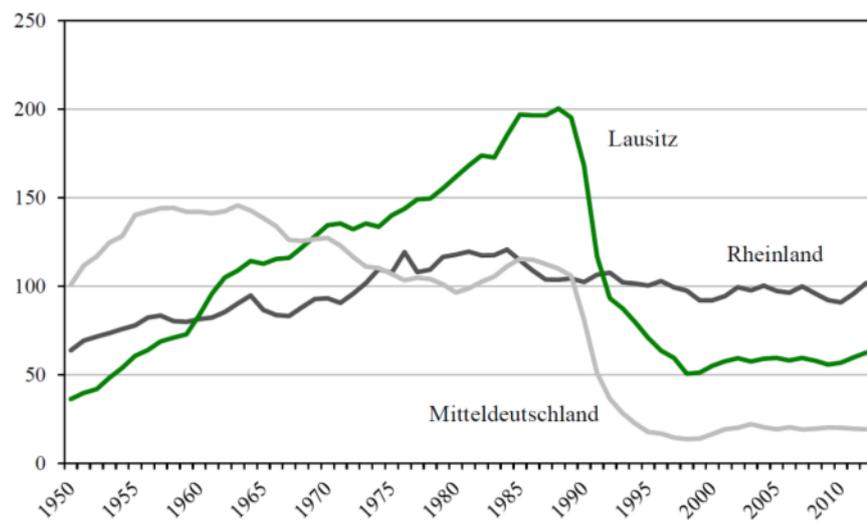
¹⁰¹ Zukunftsperspektiven für die Lausitz – Was kommt nach der Kohle? Schwartzkopff & Schulz, E3G, 2015, [link](#).

¹⁰² Industrie- und Wirtschaftsregion Lausitz: Bestandsaufnahme und Perspektiven, Joachim, Ragnitz, Kluge, Lehmann, Rösel & Gäbler, Ifo Institut Niederlassung Dresden, 2013, p. 52, [link](#).

working for supply businesses.¹⁰³ To set these numbers into the German lignite context, the largest lignite region is the Rheinisches Revier, located to the south west of the Ruhr Valley. In 2014, 93.6 MT of coal were mined and four power stations generated 10 GW.¹⁰⁴ In 2017, about 9,000 people worked in these four power stations.¹⁰⁵

The Lausitz experienced an energy transition with a high impact on the coal industry after 1990. This transition was caused by drastic changes in the political landscape. Previously under communist rule, the region became part of a democratic republic virtually overnight. Key factors affecting the Lausitz region coal industry were the decentralisation of energy provision¹⁰⁶ and central government policies¹⁰⁷ to increase renewable energy production across the whole of Germany.

The graph¹⁰⁸ to the right shows the reduction of lignite mined, in million of tonnes, in the Lausitz between 1990 and 2000 (green line). The Mitteldeutschland lignite mining area (grey line) is also located in the former East Germany, whereas the Rheinland is located in the former West Germany. Lausitz lignite mining reduced by two-thirds between 1990-2000.



In 2013, over 80% of energy generated in the Brandenburg region where most of Lausitz is located, was still generated from lignite¹⁰⁹ and most of this energy is exported to other parts of Germany. To illustrate, the energy generated in the Lausitz would cover the whole of Berlin's energy demand in excess of four years.¹¹⁰ Renewable energy generation has been presented

¹⁰³ Schwartzkopff & Schulz, 2015, *op. cit.* p. 31.

¹⁰⁴ 'Strategische Ansätze für die Gestaltung des Strukturwandels in der Lausitz - Was lässt sich aus den Erfahrungen in Nordrhein-Westfalen und dem Rheinischen Revier lernen?' Vallentin, Wehnert, Schüle & Mölter; Wuppertal Institut für Klima, Umwelt, Energie, im Auftrag der Fraktion Bündnis 90/Die Grünen im Brandenburger Landtag, 2016, p. 31, [link](#).

¹⁰⁵ Raus aus der Kohle - ohne Jobkahlschlag, Schultz, Der Spiegel, 2017, [link](#). [accessed 23/05/2018]

¹⁰⁶ Vallentin, Wehnert, Schüle & Mölter, 2016, *op. cit.* p. 32.

¹⁰⁷ Energiestrategie 2030 des Landes Brandenburg, Ministerium für Wirtschaft des Landes Brandenburg, 2012, [link](#). [accessed 23/05/2018]

¹⁰⁸ Joachim *et al.*, 2013, *op. cit.* p. 31.

¹⁰⁹ Kompetenzfeldanalyse im Zukunftsdialo g Energieregion Lausitz, Borchardt, Karg & Knetsch, Prognos AG commissioned by Energieregion Lausitz-Spreewald GmbH, 2013, p. 39, [link](#). [accessed 23/05/2018]

¹¹⁰ *ibid*, p. 40.

as an alternative for the Lausitz to reduce emissions and to create new jobs in 2017.¹¹¹ Whether this vision will become reality remains to be seen.¹¹²

The Lausitz regional government was formed based on the model of the government in the former West Germany. Little monitoring was in place and, during the post-reunification years, the whole of the former East Germany was initially mainly co-ordinated by the central government.

Impacts

Job losses: The most drastic job losses occurred within 10 years between 1990 and 2000.¹¹³ Following German reunification, the majority of the industrial centres collapsed, including the Lausitz region. The region experienced a high unemployment rate. In 1990, approximately 80,000 people worked in the Lausitz lignite industry. In 1995, this number reduced to about 20,000 and in 2000, about 7,000 workers still had jobs. Since then, employment levels have stayed fairly steady.¹¹⁴ Future scenario work commissioned by the regional government asserts that there will be, at most, 5,890 direct and indirect jobs associated with energy from lignite in the Brandenburg part of the Lausitz in the year 2030.¹¹⁵

Unemployment rates started to reduce significantly in 2004,¹¹⁶ when it was over 20%. In 2013, the unemployment rate was 9%, below the East German average of 9.8% for the same year.¹¹⁷ Since 2000, older and lower skilled workers from the coal industry are finding it especially hard to find new employment in the region.¹¹⁸ On average, previous coal industry employees stay 12.9 months unemployed before finding a new job. Other industry employees in the Lausitz region only stay unemployed for 8.3 months.¹¹⁹ The biggest differentiator within the coal industry is age. Employees under 30 years stay, on average, unemployed for 2.9 months. In contrast, previous coal industry employees above 50 years of age in the Lausitz region stay unemployed, on average, for 15.8 months.¹²⁰

Population decline: The Lausitz region is mostly rural with about 1.2m inhabitants, with only a few small towns (the largest, Cottbus, has only approximately 100,000 inhabitants) and a sprinkling of villages. The risk of people leaving the region due to job loss is high because they are unable to find alternative employment opportunities. In contrast, the Rheinische Revier

¹¹¹ *Mehrwert einer regionalen energiewende im lausitzer und im Rheinischen Revier*, Heinbach, Rupp, Hirschl & Knoefel, Report by Institut für ökologische Wirtschaftsforschung (IÖW) for Greenpeace Energy EG; 2017, [link](#).

¹¹² Schultz, 2017, *op. cit.* p. 32.

¹¹³ *ibid.*

¹¹⁴ Schwartzkopff & Schulz, 2015, *op. cit.* p. 31.

¹¹⁵ *Arbeitsplatzeffekte der Lausitzer Braunkohlewirtschaft*, Schuster R, Umweltgruppe Cottbus e.V., 2015, p. 2, [link](#).

¹¹⁶ Vallentin, Wehnert, Schüle & Mölter, 2016, p. 11, *op. cit.* p. 32.

¹¹⁷ Schwartzkopff & Schulz, 2015, *op. cit.* p. 31.

¹¹⁸ *Arbeitsplätze in der ostdeutschen Braunkohle: Strukturwandel im Interesse der Beschäftigten frühzeitig einleiten*, Franke, Hackforth and Haywood, DIW Berlin — Deutsches Institut für Wirtschaftsforschung e. V., 2017, p. 1, [link](#).

¹¹⁹ *ibid.*, p. 3.

¹²⁰ *ibid.*

region (adjacent to Ruhr Valley) has almost double the amount of inhabitants (2.1m) and a number of large cities, providing local opportunities and infrastructure for alternative job opportunities.

It has been observed that skilled workers who lose their job in the coal industry in the Lausitz do migrate to other areas.¹²¹ So it is not surprising that since reunification, workers have looked for opportunities elsewhere in Germany, leading to a decline in population in the Lausitz area (reduced from 1.43m in 1995 to 1.17m in 2013). This means that cleaner industries have a shortage of 300,000 workers, plus there is a gap in research and development (R&D) skills available in the region.¹²²

Changes in job security: Job security and secure pay were strong in the coal industry prior to German reunification. Worker's rights, however, were non-existent due to the centralist and totalitarian nature of the East German regime. Industry workers were highly respected in former East Germany. During the job losses of the reunification, the industry status rapidly changed from high status to 'polluting and bad and not future proof'. Democratic basics of worker's rights, for example the right to form unions, were only introduced in the Lausitz in 1991.

Communities: Families in the coal and other industries experienced a massive negative change in family support for working parents since 1990. At present day, challenges to make the Lausitz attractive for families and retain qualified workers, who lost their jobs in the coal industry and adjacent industries, include child support infrastructure.¹²³

Earning capacity: When finding new employment, coal industry employees are highly likely to take a pay cut. Full-time employees receive, on average, over 30% less income in their new role in a new industry, even 15 months after starting their new role.¹²⁴

Other industries affected: Job losses did not only impact the coal industry. Other industries and infrastructure intertwined with the coal industry in the Lausitz were also affected by closures after the reunification:

- paper manufacture and processing
- chemicals
- energy generation
- logistics
- industrial plant building and maintenance¹²⁵

¹²¹ Vallentin, Wehnert, Schüle & Mölter, 2016, p. 11, *op. cit.* p. 32.

¹²² Schwartzkopff & Schulz, 2015, *op. cit.* p. 31.

¹²³ Vallentin, Wehnert, Schüle & Mölter, 2016, p. 23/7 and 145, *op. cit.* p. 32.

¹²⁴ Franke, Hackforth and Haywood, 2017, p. 5, *op. cit.* p. 33.

- glass and ceramic¹²⁶

Rise of the far right: Frustrations with the lack of longer-term transition measures to mitigate the impacts of heavy industry job losses have been identified as a key factor of the rise of the far right in the former East Germany.¹²⁷ Furthermore, the impacts of the short-term measures after reunification have led to 'change fatigue' in the East; this makes it difficult to introduce new policies and initiatives that are likely to be greeted with enthusiasm by the local population.

Transition measures taken to mitigate negative impacts

Job creation: Central government created the Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft mbH (LMBV) in 1991. Initially, LMBV was tasked with making the areas of the shutdown lignite mines more secure, as well as cleaning up environmental damage caused by the industry. Twenty thousand jobs were provided through the LMBV shortly after its creation, in effect creating jobs for the redundant lignite workforce. Central government funded 75% of the LMBV, with the regional Länder budgets of Brandenburg and Sachsen picking up the remaining 25%.¹²⁸

Policy: The job losses during 1990-2000 were not high on the long-term political agenda. Only in 2015, job losses in the lignite industry were for the first time high on the public agenda due to a new climate policy proposal. In essence, highly polluting power plants would have needed to pay a penalty if exceeding certain pollution thresholds. Lignite power stations would have been most affected. The German environment office (Umweltbundesamt) commissioned a study that found that the implementation of this climate policy would have led to the loss of 4,700 jobs, about 22% of all lignite industry employees.¹²⁹ With the strong German unions in opposition, the climate policy was abolished in favour of a central government transition fund. From 2017, lignite power stations with generation capacity from 2.7 GW were halted and only fired up in energy emergencies, leading to desired closure by 2023.¹³⁰ This current transition measure leaves many questions open about the fate of the soon-to-be redundant workers. However, a complete German exit from lignite power production is viewed as inevitable by many researchers^{131,132} due to the financial costs associated with high pollution. About 22,000 lignite industry workers across Germany will be affected by the lignite exit, and policies and transition measures going forward have not been articulated.

¹²⁵ Vallentin, Wehnert, Schüle & Mölter, 2016, p. 12, *op. cit.* p. 32.

¹²⁶ *ibid.*, p. 33.

¹²⁷ *Was ist los mit dir, Ossi?* Gutsch, Der Spiegel, Issue 31, 2017, link. [accessed 23/05/2018]

¹²⁸ Schwartzkopff & Schulz, 2015, *op. cit.* p. 31.

¹²⁹ *ibid.*

¹³⁰ *ibid.*

¹³¹ Vallentin, Wehnert, Schüle & Mölter, 2016, *op. cit.* p. 32.

¹³² Schwartzkopff & Schulz, 2015, *op. cit.* p. 31.

Compensation: In 1991, coal industry workers aged 55 and above were offered early retirement. Many took up the central government on this offer.¹³³

Going forward, Agora Energiewende, a Berlin-based think tank, has suggested to address the issue of job losses in the German coal industry through a national fund, equipped with €250m (£219m) per year. This money should be solely used to encourage economic development targeted at creating alternative job opportunities for coal industry employees. The money would be used across Germany proportionally, according to the number of coal industry employees in each of the 16 regions. €250m per year is approximately 25% of the gross national product associated with lignite production across the whole of Germany in 2016.¹³⁴

Shorter work hours: A reduction in work hours for lignite workers was introduced shortly after 1990. This approach allowed a gradual shutting down of the mines and power plants without laying off workers with immediate effect. Furthermore, this policy allowed industry workers to seek alternative employment opportunities while still receiving an income from their job in the coal industry.

Training/reskilling: After 1990, technical workers and admin staff in the lignite industry were offered retraining to ease the transition to new industries.¹³⁵

Establishing an alternative key industry: After the closing of the Lausitz lignite mines during 1990-2000, many of them were flooded, creating a lake landscape with over 20 lakes.¹³⁶ Prior to German reunification, the neighbouring region was an attractive holiday destination for East Germans. As of 2014, the Lausitz tourism industry employs about 14,000 people. It should be noted, however, that many of these are seasonal workers and over 40% are classed as low-income employees.¹³⁷

¹³³ *ibid.*

¹³⁴ *Elf Eckpunkte für einen Kohlekonsens*, Agora Energiewende, 2016, pp. 9 & 43-44, [link](#).

¹³⁵ Schwartzkopff & Schulz, 2015, *op. cit.* p. 31.

¹³⁶ Gutsch, 2017, *link. op. cit.* p. 35.

¹³⁷ Schwartzkopff & Schulz, 2015, *op. cit.* p. 31.



Figure 5: Lake landscape, Lausitz¹³⁸

Private sector incentives: Central and regional governments has allowed the takeover of previously state-owned industry by the private sector since the late 1990s. Although not always successful in preserving and creating jobs, overall, this approach has been deemed successful in strengthening the local economic infrastructure.¹³⁹

Deliberate future interventions: This is not a transition measure as such, but an example of an effort to make the region more economically attractive, to halt further population decline and to generate the creation of needed skills. Founded in 2016, the Innovationsregion Lausitz GmbH (Innovation Region Lusatia) is a joint initiative from a number of local business networks and the Technical University Cottbus-Senftenberg. The initiative is explicitly researching what measures and interventions might succeed in making the region more attractive to people and businesses.

Lessons learnt

General key lessons from the Lausitz:

- Political regime change can force a transition in extremely fast timescales.

¹³⁸ Source: Press photo library, IMBV, Peter Radke, [link](#).

¹³⁹ *ibid.*

- Longer-term alternatives to coal industry employment are highly dependent on general infrastructure and the degree of urbanisation in the affected region.
- It is important to pursue short-term transition measures and long-term transition measures at the same time, to ensure regional stability beyond the effects of short-term transition measures.
- The local population has to be engaged in the transition process; without this stakeholder engagement, appetite for new transition measures is low (more in *Barriers* below).

Enablers: what worked in the approaches used

Speed: The short-term transition measures enabled the easing of the blow for mass job losses in the Lausitz region for lignite workers, mainly because they were introduced rapidly after German reunification and in parallel to the shutting down of lignite mines and power stations. The fast introduction shortly after 1990 helped workers to ease into new roles or early retirement without a large number of people being without jobs from one day to the next. This speed led to a lack of immediate unrest in the laid-off workforce, plus allowed a gentler economic transition of the Lausitz.

Co-ordinated efforts: Central government and the two Länder governments shared responsibility for the short-term transition measures, both from the implementation point of view as well as the funding. Although the central government necessarily picked up the lion share of the funds, implementation and co-ordination of the transition measures introduced immediately after 1990 were done at the regional level.

Variety: A number of transition measures were introduced in 1991, leading to social security for the lignite workforce. The measures were viewed as a 'package'. The package itself was well thought through and well received by the laid-off workers. However, many measures in the package led to stagnation for the workers. The barriers below outline the key reasons for this stagnation.

Barriers: obstacles to successful implementation of the measures deployed

No long-term view: Short-term transition measures were a success. However, after the initial creation of organisations such as the LMBV, population decline was not stopped and there were not enough immediate job prospects in the area. It seems like this mistake is currently replicated: the transition measures needed to give future prospects to the remaining 20,000 lignite industry workers across Germany until 2023 and beyond are virtually non-existent.

Ineffective marketing: Despite the successful creation of a new tourism area through flooding of the shutdown lignite mines, the Lausitz is not yet well known as an attractive tourism destination. One reason is the vast number of local tourism organisations that are not co-

ordinating efforts to market the region, plus visiting tourists receive no coherent guidance.¹⁴⁰ It seems that the 14,000 tourism employee number could be much higher if the region were to receive a larger number of visitors.

Change fatigue: The speed of the transition taking place from 1990 onwards made the Lausitz and wider East German population wary of further changes. The success of short-term transition measures was only short-term. Disillusionment with longer-term success of government interventions, especially central government interventions, makes the introduction of new initiatives difficult. This impacts, for example, a successful co-ordination of the new Lausitz lake area as a tourism hotspot, and enthusiasm by the local population for widespread energy provision through locally generated renewables.

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¹⁴⁰ Schwartzkopff & Schulz, 2015, *op. cit.* p. 31.

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5. Scotland: putting the enabling framework in place for transition

Summary

This case study explores the transition from oil and gas to low-carbon energy industry in Scotland, with specific reference to the Orkney Island experience. Scotland's economy has been powered by North Sea oil and gas since the 1970s, peaking in the late 1990s. Since then, production levels of oil and gas have been in decline, with considerable job losses experienced, especially in the north of Scotland.

From 2000, a new strategy was developed to harness Scotland's natural resource base to produce renewable energy and shift towards a low-carbon economy. Tapping into renewable resources, typically based in rather remote areas of the north and west of the country, brings job opportunities to areas with relatively high unemployment, helping to stop the migration of young people from these areas and boosting the local economy. In May 2018 the Scottish government published their draft climate change strategy setting out a target of a 90% reduction in greenhouse gas emissions by 2050. In 2017 68% of Scotland's overall electricity demand was met by renewables, the world's first floating wind farm delivered electricity to the Scottish grid.

The Orkney Islands, with the help of European Community (EC) funding, now plays a global role in the evolution of wave and tidal technologies. Significant research and development (R&D) work is creating new employment opportunities. Investment in renewable energy and its associated R&D has attracted people to live, work, and study on the island. Islanders used to have to leave to get tertiary education but it is now possible to study for an MSc in renewable energy at a Heriot-Watt University campus in Stromness. A new generation of Orcadians have grown up to see renewable energy as the way for the future, something quite 'normal' that will provide greater opportunities for their children to stay on the island with genuine prospects for employment in meaningful jobs requiring a wide range of skills and qualifications.

Scotland from oil and gas to renewables

- **Location:** Orkney Islands, Scotland
- **Time period of transition:** 2014 – present
- **Scale of transition:** 161,000 (34%) jobs were lost between 2014 and 2017 in oil and gas industry, including 13,000 (31%) of directly employed installation staff in the UK (44% of the UK oil and gas industry jobs are based in Scotland).

- **Sector in transition:** Oil and gas
- **Transition management measures taken:** Skills development – Transition Training Fund, low-carbon development strategy – Low Carbon Infrastructure Transition Programme (LCITP), Just Transition Commission, Scottish National Investment Bank.

Context and background

Scotland covers the northern third of Great Britain. In addition to the mainland, the country is made up of more than 790 islands. Scotland is rich with natural resources and nearly 15-20% of the Scottish gross domestic product (GDP) is derived from the energy sector.¹⁴¹ While there are still extremely high investments in fossil fuel energy, oil and gas pools are depleting with considerable losses in jobs. Re-establishment of the Scottish Parliament in 1999 enabled Scotland to make decisions over many areas of Scottish life, including health, education and the environment.

While the majority of energy policy is reserved to the UK Government, the numerous powers devolved to the Scottish Government provide it with substantial influence over Scotland's energy future.¹⁴²

Relatively consistent political leadership, supported by key policy choices and support mechanisms, together with industry-significant engagement and the active role of environmental non-governmental organizations (NGOs), have all helped move the sector forward. Scottish transition measures were set up to help the shift towards a more low-carbon economy. While acknowledging Scottish Government's impressive progress on large-scale renewables, the transition is still in its start-up phase.

Oil and gas sector

Scotland's economy has been powered by North Sea oil and gas from the 1970s, peaking in the late 1990s (Figure 6). Since then the sector has experienced 19 years of relentless decline. Production in 2010 was 32.4% of the 1999 peak value. Decline is a feature brought about by the depletion of reserves, and steeply and steadily increasing operating costs (see Figure 7). Total operating expenses (OPEX) for oil and gas has almost doubled from £4.5bn in 2004 to £7.8bn in 2012, while in the same period both oil and gas production have more than halved.^{143, 144} From 2000, declining levels of oil and gas resulted in job losses of around 161,000

¹⁴¹ *The energy sector in Scotland's future*, Hughes, Oxford Review of Economic Policy, 2014, vol. 30(2), pp. 374–391.

¹⁴² *Scotland: A Renewable Powerhouse*, WWF Scotland, 2013, [link](#).

¹⁴³ *Maximising Economic Recovery: The Wood Review*, Energy Matters, 2013, [link](#). [accessed 24/05/2018]

¹⁴⁴ *BP Statistical Review of World Energy*, BP, June 2013, [link](#).

between 2014-17 in the UK (estimates show that approximately half of the UK oil and gas industry jobs are based in Scotland).¹⁴⁵

Places closely connected to oil and gas production have experienced higher levels of unemployment; for example, Aberdeen (previously known as the 'Oil Capital of Europe') experienced an increase in levels of unemployment from 3.7% in 2007 to 5.2% in 2016.¹⁴⁶

Also, the population of sparsely populated areas (SPAs) has been in decline since the 1990s, but saw a brief period of expansion during the first decade of the new century. By 2007, this surge was reversed and the dropping trend is estimated to continue through to the 2040s. One of the regions most affected is Scotland's Highlands and Islands Region.¹⁴⁷ Remote communities and islands face a variety of structural conditions that are complex and require multiple levels of policy support. Connectivity to islands and remote communities is below average. Council revenues on islands and in remote communities are often low. Services are often low-quality, with high cost.

¹⁴⁵ *Economic Report 2017*, Oil & Gas UK, 2017, [link](#).

¹⁴⁶ Data from Nomis website (Official labour market statistics), Office for National Statistics, [link](#). [accessed 24/05/2018]

¹⁴⁷ *Demographic change in the Sparsely Populated Areas of Scotland (1991-2046)*, Copus and Hopkins, James Hutton Institute's Social, Economic and Geographical Sciences, 2018, [link](#).

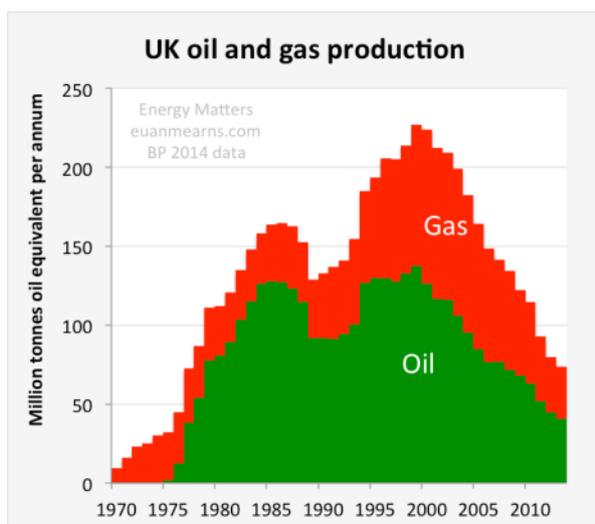


Figure 6: The history of UK oil and gas production according to the 2014 BP statistical review of world energy¹⁴⁸

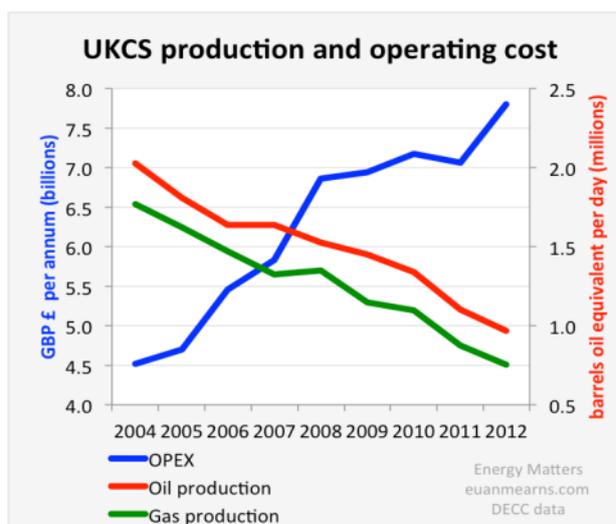


Figure 7: Plunging production and spiralling costs spells trouble ahead for the UK oil and gas industry;¹⁴⁹ 1bn cu ft of gas = 0.19m barrels of oil equivalent. Note: chart is not zero scaled¹⁵⁰

Scotland's transition from oil and gas to low-carbon economy

Scotland's huge renewable energy resources offer enormous opportunities. Growing national concerns regarding peak oil, job losses from the oil and gas industry, and climate change have driven the focus on renewable energy high up the political agenda. Various public bodies and public-private partnerships have been created to develop this potential. Scotland generated 59% of its electricity consumption through renewable sources in 2015, exceeding its set goal of 50% (by 2015).¹⁵¹ The Scottish Government's Energy Strategy set a target for 100% of electricity consumption to be generated through renewable sources by 2020, and 50% of total energy consumption (including transportation) by 2030.^{152,153}

The Transition Training Fund

As a response to an increasing number of job losses from the oil and gas industry, in 2016 the Scottish Government set up the Transition Training Fund (£12m) managed by Skills Development Scotland to help those who have been made redundant from the oil and gas sector.¹⁵⁴ It offers support with training grants to help workers to retrain, upskill or get certification that would help them to get a new job in oil and gas, the broader energy sector

¹⁴⁸ Energy Matters, 2013, *op. cit.* p. 42.

¹⁴⁹ OPEX from DECC (Department of Energy and Climate Change), oil and gas production from BP.

¹⁵⁰ Energy Matters, 2013, *op. cit.* p. 42.

¹⁵¹ *Renewables in Numbers*, Scottish Renewables, [link](#). [accessed 24/05/2018]

¹⁵² *ibid.*

¹⁵³ *The future of energy in Scotland*, Scottish Government, 24 January 2017, [link](#). [accessed 24/05/2018]

¹⁵⁴ *Transition Training Fund*, Skills Development Scotland, [link](#). [accessed 24/05/2018]

(including renewable energy), or production and manufacturing. The fund also supports transition of people with science, technology, engineering and mathematics (STEM) skills to move towards related teaching. It has approved 3,184 applications to date and the rate of success in finding a new job after retraining is 85%. In a survey of 781 recipients, 199 provided a new job title. The top three sectors were: 27% in skilled trades, 24% in transportation and 15% in renewables or other engineering.¹⁵⁵

Job opportunities

The creation of 'green' job opportunities in the energy sector is an important part of long-term transition measures towards a low-carbon future and the Scottish low-carbon economy strategy.¹⁵⁶ For example, the number of jobs in the low carbon and renewables sector has increased rapidly from 43,500 in 2014 to 58,500 in 2015 according to the Office of National Statistics.¹⁵⁷

Currently there are around *"156,000 workers employed in fossil fuel extraction in Scotland, of which one-third are export-oriented jobs. Estimates show that the new economy could in comparison employ more than 200,000 by 2035"*.¹⁵⁸

Planning guidelines

New planning guidelines on renewable energy were produced in 2007. These advised local authorities to use the planning system to *"manage the process of encouraging, approving and implementing renewable energy proposals"*.¹⁵⁹ The policy is planned to support delivery of the renewable energy targets and encourage the economic-environmental benefits that renewables can deliver. Additionally, there are various online toolkits, guidelines and documents designed for renewable technologies with regular updates to stay in line with this incredibly fast-moving industry. However, funding and investment remains difficult to procure. Capital is available but the certainty that investors require is absent with cuts in subsidies, changing energy policy and wider political changes across the UK.

In September 2017, the Scottish Government announced the creation of a major new investment public bank called the Scottish National Investment Bank. There is great potential, with the right mandate and governance, for a new bank to make the crucial difference in Just Transition funding towards low-carbon economy in Scotland.¹⁶⁰

¹⁵⁵ *ibid.*

¹⁵⁶ *The Low Carbon Economic Strategy*, The Scottish Government, November 2010, [link](#).

¹⁵⁷ *Green jobs increase*, Scottish Government, 6 April 2017, [link](#). [accessed 23/05/2018]

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Community engagement

The plans for project development in the Highlands and Islands region reflect the significant amount of suitable resources for wind, wave and tidal technologies. Seizing sub-regional benefits is of great significance for policymakers and developers, mainly due to the socio-economic fragility of the Highlands and Islands region and its decreasing population.

In the last decade, Scottish Government promoted marine renewable energy technologies and small-scale onshore wind farms in rural communities, as a way to achieve energy security, economic development and environmental sustainability. However, research shows that, with *“no local ownership by landowners or communities, wind developments do have a significant effect on rural GDP but little or no wider effects with no effect on household incomes.*

Significant spill-over effects only occur if additional factor incomes associated with local ownership (land rentals and returns on investment) are re-invested in the local economy.”¹⁶¹

The Scottish Government plans to ensure that nearly 50% of renewable energy projects will have some element of shared ownership by 2020.¹⁶² It is estimated that 17,950 individual community or locally-owned renewable energy installations were operational in Scotland in 2017, a 15% increase compared to 2016 (Table 2).¹⁶³

Table 2: Community-owned renewable energy (ownership category) installation estimates for 2017 compared to 2016¹⁶⁴

Ownership category	Operational capacity (MW)	% of operational capacity	% increase in capacity compare to 2016	Number of operational installations	% of operational installations	% increase in installations compare to 2016
Community	81	12%	21%	530	3%	4%
Farms and estates	266	40%	9%	600	3%	8%
Housing association	59	9%	25%	9,390	52%	10%
Local authority	120	18%	12%	6,440	36%	30%
Local businesses	77	12%	4%	540	3%	1%
Other public sector and charity	62	9%	13%	450	3%	2%
Total	666	100%	12%	17,950	15%	100%

Communities have commonly been unable to reduce energy costs to local residents because of limitations in the supply chain and distribution of electricity. However, the *“energy industry is actively exploring systems involving relatively small volumes of electricity being conveniently matched between producers and consumers, allowing community groups to more closely*

¹⁶¹ *Measuring the Local Economic Impact of Community-Owned Energy Projects*, Entwistle, Roberts and Xu, Gilmorton Rural Development and the James Hutton Institute, 2014, p. 17.

¹⁶² *Community and locally owned renewable energy in Scotland at June 2017*, Energy Saving Trust, 2017, [link](#).

¹⁶³ *ibid*.

¹⁶⁴ Source: *ibid*, p. 9.

*approach the final consumer.*¹⁶⁵ Community Energy Scotland is actively exploring these opportunities in Scotland, forming collaborations and groups with Highlands and Islands Enterprise and Scottish community groups through CARES Infrastructure and Innovation Funding¹⁶⁶ and the Local Energy Economies Programme.¹⁶⁷

The role of the EU

The EC has played an important role in the transition towards a low-carbon economy. Scotland is a recipient of European bank loans, grant funding and other forms of financial support for research, innovation, and development of clean energy technologies. The Scottish Government, in 'Scotland's Place in Europe', highlights examples of:

- Scottish marine pilot schemes funded by the European Investment Bank (EIB):
 - €37.4m funding for MeyGen phase 1B and the Sound of Islay;
 - £525m for Beatrice offshore wind farm (the largest EIB loan for an offshore wind project).¹⁶⁸
- Horizon 2020 €10m funding has been provided to Scotrenewables Tidal Power for its Floating Tidal Energy Commercialisation project.¹⁶⁹
- European Structural and Investment Funds co-finance Scotland's LCITP, providing considerable investments in low-carbon infrastructure programmes over the period from 2014-2020.
- Providing match funding for investments in low-carbon infrastructure programmes and sustainability initiatives over the period from 2014-2020.¹⁷⁰

*"While funds already committed are unlikely to be affected by Brexit, future funding is far less clear. New sources on the horizon, such as the ETS Innovation Fund, may be out of reach post-Brexit."*¹⁷¹

A strong civil society movement

The Scottish Trade Union Congress, Communication Workers Union Scotland, Public and Commercial Services Union Scotland, Unite Scotland, Unison Scotland, University and College Union Scotland, and WWF Scotland have all successfully lobbied for 'Just Transition' measures with benefits to local communities. The Scottish Government has announced creation of a Just

¹⁶⁵ Entwistle, Roberts and Xu, 2014, p. 4, *op. cit.* p. 45.

¹⁶⁶ *Community And Renewable Energy Scheme - Overview of Support*, Scottish Government, [link](#). [accessed 24/05/2018]

¹⁶⁷ *About Local Energy Economies*, Community Energy Scotland, [link](#). [accessed 24/05/2018]

¹⁶⁸ *The potential impact of Brexit on Scotland's renewable electricity ambitions*, Zeniewski P, University of Edinburgh, 2017, [link](#).

¹⁶⁹ *ibid.*

¹⁷⁰ *Scotland's Place in Europe*, Scottish Government, 2016, [link](#).

¹⁷¹ Zeniewski P, 2017, *op. cit.* p. 46.

Transition Commission to advise Scottish ministers on the move towards a fair low-carbon economy.¹⁷²

The Orkney Island Archipelago experience: becoming a global player

This archipelago, comprising of approximately 70 islands, of which 20 are inhabited, is located north of the Scottish mainland, a two hour journey by ferry. Orkney's climate is heavily influenced by the sea, in particular the Gulf Stream. It is a marine west coast climate which is mild and cool with no dry season and warm summers. The winds and stormy seas have shaped the life of islanders.

Life on the island traditionally relied on farming and fishing; however, depopulation and needs of young people to go to study in mainland universities threatened numbers of Orcadians and the opportunities to live on the islands. North Sea oil, discovered in the 1970s, brought positive and negatives for the island. Both the Orkney and Shetland Islands have pushed for rights to manage part of the benefits derived from the fossil resources extracted locally, finally granted in Orkney and Shetland in the County Council Act 1974.¹⁷³ In the time of slow oil depletion, another 'end of an era' is approaching.¹⁷⁴ The revenues from oil and gas gave Orkney Council the opportunity to start a discussion about the island's future and to invest in low-carbon technology and infrastructure (especially marine and tidal).

EC funding has helped Orkney to equip itself for the green energy revolution. In 2003, the European Marine Energy Centre (EMEC) (Figure 8) was established with an approximate £34m fund from the Scottish Government, Highlands and Islands Enterprise, the Carbon Trust, UK Government, Scottish Enterprise, the EU and Orkney Islands Council.¹⁷⁵ It is the first and only centre of its kind in the world to provide developers of both wave and tidal energy converters with technologies that generate electricity (by harnessing the power of waves and tidal streams) with purpose-built, grid-connected and independently accredited open-sea testing facilities.¹⁷⁶

Orkney now plays a global role in the evolution of wave and tidal technologies. Significant R&D work is creating new employment opportunities. Installation of wind turbines in Scotland has also created Scottish jobs in civil works and erection, grid connection and communications.

In 2004, Pelamis (a wave power device) became the world's first attempt to successfully generate electricity for the National Grid. In 2011, the world's largest single-rotor tidal turbine, made by Atlantis, came to be Scotland's first grid-connected, commercial-scale tidal turbine, marking a crucial milestone in the development of the marine energy industry. Marine energy, combined with an expansion of wind turbines, means that the island is now self-sufficient in electricity.¹⁷⁷

*"Local production of renewable electricity has grown and in 2016 Orkney produced 120.5% of its electricity needs."*¹⁷⁸

¹⁷² *Climate Change*, Scottish Government, 2017, [link](#). [accessed 24/05/2018]

¹⁷³ *A transformational paradigm for marine renewable energy development*, Graziano, Billing, Kenter & Greenhill, Energy research & social science, vol. 23, pp. 136-147, 2017.

¹⁷⁴ *Jobs after coal: A just transition for New Zealand communities*, Baxter *et al.*, Coal Action Network Aotearoa, 2015, [link](#).

¹⁷⁵ *Funders*, The European Marine Energy Centre website, [link](#). [accessed 24/05/2018]

¹⁷⁶ *Marine renewables and coastal communities—Experiences from the offshore oil industry in the 1970s and their relevance to marine renewables in the 2010s*. Johnson, Kerr & Side, Marine Policy, vol. 38, pp. 491-499, 2013.

¹⁷⁷ *Orkney Islands Provide A Glimpse Of A Renewable Future*, Atlantis Resources, September 2011, [link](#). [accessed 24/05/2018]

¹⁷⁸ *Orkney Sustainable Energy Strategy 2017/2025*, Energy of Orkney, [link](#).

The Orkney Island Archipelago experience: becoming a global player



Figure 8: European Marine Energy Centre (EMEC), Orkney¹⁷⁹

Orkney and its partners are involved in a range of innovative carbon reducing projects like the Surf'n'Turf, and Building Innovative Green Hydrogen in Isolated Territories (BIGHIT) Hydrogen Projects aimed at overcoming local grid constraints.¹⁸⁰ Underdeveloped grid connection in Scotland is often cited as one of the biggest constraints to transition towards a low-carbon future.¹⁸¹

Marine energy supports around 300 jobs¹⁸² in Orkney from manufacturing and engineering to marine work, research and consultancy services. Jobs continue to grow, especially through an impressive supply chain of local businesses.¹⁸³ The unemployment rate (% job seekers) in Orkney dropped from 1.8% in 2004¹⁸⁴ to 0.8% in 2016,¹⁸⁵ becoming the region in Scotland with one of the lowest unemployment rates. New opportunities on the islands have helped to turn a tide of depopulation, from 19,290 Orcadians living on the islands in 2000 to 21, 670 in 2015.^{186,187}

Investment in renewable energy and its associated R&D has attracted people to live, work, and study on the island. Islanders used to have to leave to get tertiary education but it is now possible to study for an MSc in renewable energy at a Heriot-Watt University campus in Stromness.¹⁸⁸ A new generation of Orcadians have grown up to see renewable energy as the way for the future, something quite 'normal' that will provide greater opportunities for their children to stay on the

¹⁷⁹ Source: [link](#).

¹⁸⁰ *BIG HIT to make Orkney a model hydrogen territory* (Report), Fuel Cells Bulletin, vol. 14(2), 2016.

¹⁸¹ Graziano, Billing, Kenter & Greenhill, 2017, *op. cit.* p. 47.

¹⁸² *Energy of Orkney*, Orkney.com, [link](#). [accessed 24/05/2018]

¹⁸³ Orkney Renewable Energy Forum (OREF) website, [link](#). [accessed 24/05/2018]

¹⁸⁴ *Orkney Economic Review 2012-13*, Orkney Islands Council, [link](#).

¹⁸⁵ *Orkney Economic Review 2015/2016*, Orkney Islands Council, [link](#).

¹⁸⁶ *Orkney Economic Review 2012-13*, Orkney Islands Council, [link](#).

¹⁸⁷ *Orkney Economic Review 2015/2016*, Orkney Islands Council, [link](#).

¹⁸⁸ *What is it like to study and live in Orkney?*, Heriot-Watt University, [link](#). [accessed 24/05/2018]

The Orkney Island Archipelago experience: becoming a global player

island with genuine prospects for employment in meaningful jobs requiring a wide range of skills and qualifications. The first smart grid (for Active Network Management) was installed in Orkney, the first of its kind, and remains at the cutting edge of smart grid implementation.^{189,190}

Orkney Island Council includes communities in discussion on the future of the archipelago. A new 'Sustainable Energy Strategy 2017-2025' has been developed in partnership by, amongst others, Orkney Islands Council, Highlands and Islands Enterprise (HIE), Community Energy Scotland (CES) and the Orkney Renewable Energy Forum (OREF). The consultation process included relevant partners, the local supply chain, as well as the wider public, and the strategy was endorsed by the Orkney Partnership.¹⁹¹ It presents a vision for the islands:

"A secure low-carbon island economy driven uniquely by innovation and collaboration, enabling the community to achieve ambitious carbon reduction targets, address fuel poverty and provide energy systems solutions to the world.

Realising this vision will deliver the following strategic outcomes:

- *The achievement of ambitious carbon reduction targets.*
- *The reduction and eradication of fuel poverty in Orkney.*
- *Positioning Orkney as the globally recognised innovation region to develop solutions for the world's energy systems challenges.*
- *Ensure a secure energy supply during transition to a low-carbon future."*¹⁹²

Impacts

Job losses: From 2000, declining levels of oil and gas resulted in job losses of around 161,000 between 2014-2017 in the UK.¹⁹³ Most of the regions affected are located north and east of Scotland.

Unemployment: Places closely connected to oil and gas production experienced higher levels of unemployment; for example, Aberdeen (previously known as the 'Oil Capital of Europe') experienced increase in levels of unemployment from 3.7% in 2007 to 5.2% in 2016.¹⁹⁴

Population decline: The population of SPAs has declined since the 1990s, but saw a brief period of expansion during the first decade of the new century. By 2007, this surge was reversed and the downward trend is estimated to continue through to the 2040s.¹⁹⁵ One of the regions mostly effected is Scotland's Highlands and Islands Region.¹⁹⁶

¹⁸⁹ Energy of Orkney, *op. cit.* p. 48.

¹⁹⁰ *Second generation active network management on Orkney*, Foote *et al.*, 2013.

¹⁹¹ Community Planning in Orkney, The Orkney Partnership, [link](#).

¹⁹² *Sustainable Orkney Energy Strategy 2017-2025* (draft), Orkney Islands Council, 2017, p. 5, [link](#).

¹⁹³ Oil & Gas UK, 2017, *op. cit.* p. 42.

¹⁹⁴ Office for National Statistics, *op. cit.* p. 43.

¹⁹⁵ Copus and Hopkins, 2018, *op. cit.* p. 43.

¹⁹⁶ *ibid.*

Transition measures taken to mitigate negative impacts

Job creation: Investments in low-carbon industry and creating 'green' job opportunities. The number of jobs in the low carbon and renewables sector has increased rapidly from 43,500 in 2014 to 58,500 in 2015.¹⁹⁷

Government measures: The Scottish Government has announced the creation of a Just Transition Commission to advise Scottish ministers on the move towards a fair low-carbon economy.¹⁹⁸

The Scottish Government announced creation of a major new public investment bank called the Scottish National Investment Bank in September 2017. There is great potential, with the right mandate and governance, for a new bank to make the crucial difference in Just Transition funding towards a low-carbon economy in Scotland.¹⁹⁹

Policy: New planning guidelines were produced in 2007 on renewable energy. These advised local authorities to use the planning system to "*manage the process of encouraging, approving and implementing renewable energy proposals*".²⁰⁰

Training/reskilling: The Transition Training Fund (£12m) was set up in 2016 as a response to the increasing number of job losses from the oil and gas industry.²⁰¹ The fund offers support to workers who have been made redundant from the oil and gas sector since January 2015 by providing training grants for retraining, obtaining new skills, accreditation or certification, including 340 training course places in the renewables sector. It has approved 3,184 applications to date and the rate of success in finding a new job after retraining is 85%.²⁰² In a survey of 781 recipients, 199 provided a new job title. The top three sectors were: 27% are in skilled trades, 24% are in transportation and 15% are in renewables or other engineering.

European Union funding: EC funding helped Orkney to equip itself for the green energy revolution. In 2003, the EMEC was established with around £34m of funding.²⁰³ It is the first and only centre of its kind in the world to provide developers of both wave and tidal energy converters with technologies that generate electricity by harnessing the power of waves and tidal streams.

The LCITP, co-funded by the European Regional Development Fund, provides funding for large-scale projects supporting Scotland's ambitious Energy Strategy published in 2017. The LCITP has already approved funding of over £40m to 16 low-carbon energy generation demonstrator

¹⁹⁷ Scottish Government, 2017, *op. cit.* p. 44.

¹⁹⁸ Scottish Government, 2017, *op. cit.* p. 47.

¹⁹⁹ SNIB, Scottish Government, 2017, *op. cit.* p. 45.

²⁰⁰ Scottish Executive Development Department, 2007, *op. cit.* p. 44.

²⁰¹ Skills Development Scotland, *op. cit.* p. 44.

²⁰² *ibid.*

²⁰³ The European Marine Energy Centre website, *op. cit.* p. 47.

projects and provided support to co-development of over 30 proof of concept and development proposals.²⁰⁴

Lessons learnt

It is important to pursue both long- and short-term transition measures at the same time. The Orkney Island Archipelago shows that skills development, together with longer-term plans in renewable energy development, resulted in one of the lowest unemployment levels in Scotland and reversed the decrease in population.

Training and reskilling are crucial for a successful transition. The Transition Training Fund has approved 3,184 applications to date and the rate of success in finding a new job after retraining is 85%.

EU funding has enabled Scotland to move towards a low-carbon economy and create a considerable number of new jobs in the renewable sector. The case study from the Orkney Islands shows that with development of the EMEC, 300 new jobs were created and the islands become leaders in marine and tidal energy technology development.

Investment in renewable energy and its associated R&D has attracted people to live, work, and study on the Orkney Islands.

Strong Civic Society pushed for Just Transition in Scotland. The Scottish Government has announced the creation of a Just Transition Commission to advise Scottish ministers on the move towards a fair low-carbon economy.²⁰⁵

Enablers: what worked in the approaches used

Strong political leadership: Relatively consistent political leadership supported by key policy choices and support mechanism, together with industry-significant engagement and the active role of environmental NGOs have all helped move towards a low-carbon economy.

Local council working with the local community: The Orkney Island Council included communities in the discussion on the island's future. They have a strong strategy for the island's development and reinvest funds from the oil and gas industry towards low-carbon development.

Speed: The short-term transition measures enabled the easing of the blow for mass job losses from the oil and gas industry.

Enabling innovation: Innovation in marine and tidal energy technology invited further investment and partnership in this sector. This is particularly true with the EU relationship.

²⁰⁴ *Low Carbon Infrastructure Transition Programme - Supported Projects*, Scottish Government, [link](#). [accessed 24/05/2018]

²⁰⁵ Scottish Government, 2017, *op. cit.* p. 47.

Barriers: obstacles to successful implementation of the measures deployed

Remote communities and islands: These have a variety of structural conditions that are complex and require multiple levels of policy support. Connectivity to islands and remote communities are below average. Council revenues on islands and on remote communities are often low. Economic transformation is often slower. Services are often low-quality, with high cost.

Grid infrastructure: Grid connection is vital for the socio-economic wellbeing of Scottish communities. Scotland's grid system is often antiquated and needs significant upgrades and innovations to ensure that Scotland will reach its full energy potential, battle energy poverty and meets its climate change commitments and renewable energy targets.²⁰⁶

Dealing with uncertainty and lack of funding: Funding and investment remains difficult to procure. Capital is available but the certainty that investors require is absent with energy policy changes and wider political changes in the UK. There is an uncertainty about EU funding after Brexit. This might undermine the transition process towards a low-carbon economy, especially new technology development projects.

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