

Regional governance, innovation and low carbon transitions: exploring the case of Wales

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Abstract

With the rapid development of its iron and coal industries, by the mid-18th Century South Wales arguably emerged as the world's first carbon-based economy. Since the mid-20th century 'landscape' changes, associated with: i) energy regime shifts from coal to oil and gas; and ii) globalisation and neo-liberalism have combined to drive the equally rapid de-industrialisation of the Welsh economy: a process which has left a structural legacy of economic and social deprivation across much of the region. In this context devolution and the establishment of a Welsh Assembly Government (WAG) with a statutory duty to promote sustainable development, has presented both unique opportunities and challenges. Despite limited powers WAG is determined that Wales will play an internationally leading role in tackling climate change. Rather than simply acting as a 'policy taker', WAG has established ambitious targets which exceed current UK and international commitments: including a 3% annual reduction in GGE in areas of devolved competence; all new buildings to be zero carbon; and to produce as much electricity from renewable sources as is consumed in Wales by 2025. This paper will explore the politics of sustainable regions through the governance of energy and innovation in Wales. Particular attention will be paid to: i) insights from past transitions; ii) the economic and political context of devolution; iii) the emergence of a distinctive Welsh 'transition' narrative; iv) and the role of innovation in the built environment, and associated regional innovation systems, not only in delivering WAG's carbon reduction targets but also its social and economic objectives.

Key words: sustainable regions; transitions; low-carbon; innovation

1. Introduction

With a population of just under three million people, Wales is a relatively small country located on the western periphery of the United Kingdom (UK). Whilst Wales has a long industrial history, and can arguably claim to have led the transition to a carbon economy in the 18th Century, much of Wales is today relatively poor by UK and European standards. Despite the social and economic challenges with which it is faced, Wales is also a politically and culturally dynamic nation. Over the last decade a progressive process of devolution has for the first time seen the establishment of an elected regional government in Wales. Moreover, this process has also led to Wales becoming one of only three countries in the world to have a duty to promote sustainable development written into its constitution. For some senior political figures in Wales, this commitment to sustainable development represents an opportunity to forge a new Welsh identity, and despite its limited powers the Welsh Assembly Government (WAG) is determined that Wales will play an internationally leading role in tackling climate change and the transition to a low carbon economy. Rather than simply acting as a 'policy taker', WAG has established ambitious carbon reduction targets which exceed current UK and international commitments.

This paper will explore the politics of sustainable regions through the governance of energy and innovation in Wales. Particular attention will be paid to: i) insights from past transitions; ii) the economic and political context of devolution; iii) the emergence of a distinctive Welsh 'transition' narrative; iv) and the role of innovation in the built environment, and associated regional innovation systems, not only in delivering WAG's carbon reduction targets but also its social and economic objectives.

The paper is part of an emerging programme of work undertaken under the auspices of the Low Carbon Research Institute (LCRI)¹. Specifically it will contribute to the initial scoping and review work for the Low Carbon Build Environment project of the LCRI/WEFO Convergence Energy Programme. The paper also draws heavily on Yan Wang's on going doctoral research developing a conceptual policy model for the transition to a low carbon economy in Wales.

¹ www.lcri.org.uk/

This paper is structured as follows. Section 2 briefly reviews the reflexive governance, socio-technical transitions and innovation systems in literature in order to place the policy and governance challenges confronting WAG, in seeking to promote a purposive transition to a low carbon economy, in their broader context. Section 3 seeks to place this current work in a longer historical context, through providing an overview of past transitions and patterns of economic development in Wales. Particular attention is paid to the factors underpinning the rise and subsequent decline of the carbon intensive coal and iron and steel industries, together with the role of regional policy in attempts to promote diversification of the Welsh economy. Section 4 describes the more recent socio-economic structure of the Welsh economy and provides an overview of the legal, political and institutional changes which have underpinned the devolution process. Section 5 provides an overview of current patterns of energy production and consumption in Wales, a summary of the WAG's policy objectives and carbon reduction targets, and preliminary analysis of the policy discourse underpinning these. Section 6 briefly discusses how we intend to apply an 'innovations systems' approach to mapping the emergence of a low carbon built environment innovation system in Wales. Section 7 seeks to critically reflect on the governance challenges, facing the transition to a low carbon economy from a Welsh perspective and draw some initial conclusions from this work.

2. Transitions theory & innovation systems

Transition theory was introduced as a new governance model for achieving sustainable development around a decade ago (Kemp and Loorbach 2006, Rotmans and Loorbach 2008). Over the years, researchers with different disciplinary background have referred to it under a variety of concepts, including system innovation, regime transformation, industrial transformation, technological transition, and socio-economic paradigm shift (Elzen and Wieczorek 2005). The idea of transition has growing normative appeal for not only academia but also policy-makers. As Shove and Walker (2007) described, *"If 'we' can steer change, shape future development and manage movement in desired directions, perhaps 'we' can make the environment a better and more sustainable place in which to live."*

Transition theory draws heavily on concepts from innovation studies (Elzen and Wieczorek 2005, Loorbach and Rotmans 2010), particularly the notion of technological trajectories (Dosi 1982, Elzen and Wieczorek 2005), to portray the multi-level (component, firm and

system) path-dependent evolution of technological development soon after dominant designs are established (Green et al. 1994). The dominant technological trajectories produce inertial forces and limits change to incremental developments that are consistent with the dominant design (Christensen and Bower 1996, Jenkins and Floyd 2001), such as our existing development model that is “locked-in” at trajectories driven by short-term benefits rather than long-term sustainable development (Kemp and Soete 1992, Kemp and Loorbach 2006).

Transition theory uses Rip and Kemp’s ‘multi-level’ model of innovation (1998) to distinguish three levels of socio-technical systems: macro socio-technical landscape, meso level regime (institutions, dominant infrastructure and technologies) and micro level niche (individual actors, technologies and local practices). The concept is that a transition takes place through processes of co-evolution and mutual adaptation within and between these layers (Shove and Walker 2007), as the result of interaction between changes and innovations within and between these levels. Therefore, any transition toward sustainability requires *a substantial degree of socio-cultural change coupled to a similar high level of technological change* (Elzen and Wieczorek 2005).

Transition process exhibit non-linear behaviour, and can be roughly divided into four phases [figure 1]: *Predevelopment, Take-off, Breakthrough* and *Stabilisation*, and span over one or two generations (Rotmans et al. 2000; Kemp and Loorbach 2006).

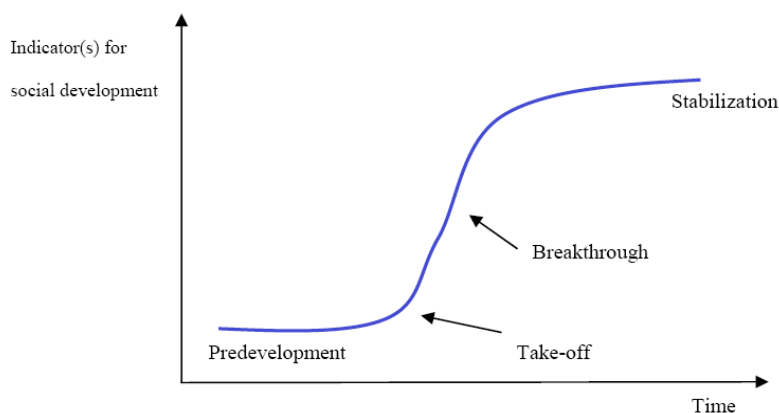


Figure 1. Four phases of a transition (Sources: Rotmans et al. 2000 and 2001)

The Dutch government became the first to adopt transition management as official policy in the fourth Dutch National Environmental Policy Plan in 2001. The Dutch model uses an integrative and multi-scale framework for policy deliberation, selection of instruments and actions by individuals, organisations and society at large, and calls for long-term orientation while using it for setting up intermediate and short-term policies (Kemp and Loorbach 2006). The process is illustrated into a transition management cycle [figure 2] with a number of components: (i) structure the problem in question, and establish and organize the transition arena; (ii) develop a transition agenda, images of sustainability, and derive the necessary transition paths; (iii) establish and carry out transition experiments, and mobilize the resulting transition networks; (iv) monitor, evaluate and learn lessons from the transition experiments and, based on these, make adjustments in the vision, agenda and coalitions; amongst the transition arena has a pivot role (Loorbach and Rotmans 2010).

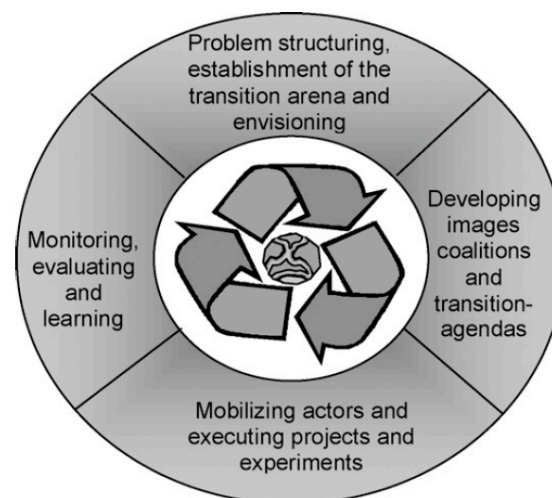


Figure 2 Transition Management Cycle

(Sources: Kemp and Loorbach 2006; Loorbach and Rotmans 2010)

This model of transition management advocated by Kemp and Rotmans aims for long-term change through relatively small steps so mitigating the risk of lock-in, and interprets managing as searching, learning, experimenting rather than command and control, thus in a subtle way by expediting and simulating transition processes towards a more sustainable state (Rotmans and Loorbach 2008). Nevertheless, concerns have been raised with regard to how it is possible to identify and develop the necessary conditions and critical junctures

for steering sustainable socio-technical trajectories. Some believe that the solution, may in part at least, be found through the Technological Innovation System (TIS) approach.

Technological Innovation System (Carlsson and Stankiewicz, 1991) is one of four innovation system approaches developed in the literature over the past two decades. The others include National Innovation System (Freeman 1987; Lundvall 1992; Nelson 1992), Regional Innovation System (Cooke 1996, Maskell and Malmberg 1997) and Sectoral Innovation Systems (Breschi and Malerba 1997). In all, the notion of innovation system adopts a system approach to identify and analyse elements that interact in shaping innovation processes as well as elements that link innovation to economic performance (Lundvall 1992). A number of regional and national bodies /governments e.g. OECD and EU have adopted the innovation system approach in seeking to bring the supply of science into closer harmony with the demands of society (Godin 2009).

Given the clear geographical dimension of National, Regional and Sectoral Innovation Systems, Carlsson and colleagues suggested that innovation in particular techno-economic areas may or may not be geographically and institutionally localised within nations or regions but also linked to supporting institutions elsewhere (Carlsson 2006). They thereby introduced the Technological Innovation System approach, and defined it as '*a dynamic network of agents interacting in a specific economic/industrial area under a particular institutional infrastructure and involved in the generation, diffusion, and utilisation of technology*' (Carlsson and Stankiewicz, 1991). In recent years, TIS has been particularly used to explain why and how sustainable energy technologies (e.g. biomass technology) have developed and diffused into a society, or have failed to do so (Negro and Hekkert 2008; Hekkert and Negro 2009)

One critical contribution derived from the TIS study is the introduction of the System Functions approach, which encompasses seven key processes that have direct and immediate impacts on the development, diffusion and use of new technologies. The seven system functions include (i) Entrepreneurial Activities; (ii) R&D / Knowledge Development; (iii) Networks of Knowledge Diffusion; (iv) Guidance of the Search; (v) Market Formation; (vi) Resource (materials, financial and human) Mobilisation, and (vii) Creation of Legitimacy / Counteract Resistance to Change (Bergek et al. 2008; Hekkert and Negro 2009). By

separating structure from content, the System Functions approach provides an analytical framework against which policymakers can evaluate the performance of the existing innovation system and develop appropriate policy interventions, in order to alter the functional pattern through strengthening/adding inducement mechanisms and/or weakening/removing blocking mechanism (Bergek et al. 2008).

The approaches of National, Regional, Sectoral and Technological Innovation System all have their respective place in understanding the nature of the innovation activities and their links to economic development. As Freeman argued (1995), in spite of growing internationalisation of innovative activities, national and regional systems of innovation remain essentials, because key elements, e.g. national educational system, industrial relations, research institutes, government policies, cultural traditions and many other national/regional/local institutions, are fundamental for any firm to innovation. Different institutions are likely more important than others for innovation activities at national, regional or local levels respectively, while some are specific for particular sectors or technologies. Nevertheless they represent a legacy of the past and only change very gradually, therefore creating strong path dependence (Carlsson 2006).

As Wales seeks to undergo a transition to a low carbon economy, this will inevitably involve the adoption and diffusion of new technologies embedded in new economic, social, institutional and cultural relations, with wholesale changes to systems of production, distribution and consumption. We argue that it will be essential for transition management for low carbon to coalesce with the innovation system approach, particularly Regional and Technological innovation systems, in order to analyse the functional dynamics of a transition process, and identify critical junctures and conditions for creating and managing a low carbon path dependence.

3. Past transitions and patterns of economic development in Wales

“There are different ways of looking at the world. It would be easy to look back on the old century in Wales as one of exploitation, where mineral and human resources were systematically and ruthlessly expended in creating industrial dereliction and social exclusion. (Williams 1985; Hill 2000)

Until 1850, Wales remained predominately an agricultural society geographically isolated from the rest of UK, due to the poor road link within and between Wales and England. As a nation Wales largely missed out on the technological and economical progress created by the First Industry Revolution (1700 – 1850), associated with the water power and mechanisation of the cotton and textiles sectors, and was left far behind its English neighbour.

3.1 Transition to Carbon Economy

The rapid industrialisation of South Wales began with the Iron Boom between 1760 and 1850, centred in the town of Merthyr Tydfil. Nevertheless, the most important outcome of the Industrial Revolution in Wales was the growth of coal mining, which overtook iron mining to become the largest industry in Wales by 1850, as a result of sudden rise in demand for the ‘steam coal’ of South Wales to fuel railway locomotives, steamships and steam-powered machinery in the newly industrialising countries. At the beginning of the 20th Century the price of world coal was set in Cardiff (WAG 2010), when coal output in Wales peaked in 1913 at 57 millions tonnes, with 65% of this output being exported. At that time the industry employed some 270,000 men (Jenkins 1975). Therefore, it may be argued that South Wales lead the world in the transition to a carbon-based economy.

During the second half of 19th century, Wales also experienced the invasion of modern steelmaking technologies, and iron products were soon substituted by steel for building rails, ships and machinery, etc. From the late 19th century large scale steelworks were built in East Moors Cardiff and Port Talbot, while further steel plants were opened in south as well as north Wales during the 20th century (Jenkins 1975). In addition, from the middle of 18th century, the mining of slate in north Wales, copper ores near Anglesey and the development of the tinsplate industries in South Wales all made significant contributions to the country’s economic development.

The transport infrastructure in Wales also experienced major transformation and improvement in order to accommodate the needs of these heavy industries. From ‘Canal mania’ (1790- 1840), to major ports built in south Wales e.g. Cardiff, Swansea, Newport and

Barry (since 1790s), to rail expansion (1840 onwards), these lines of transportation not only linked the coal and iron regions with the ports in south Wales, and exported Welsh coal to the rest of world, but also transformed Wales' social and economic pattern of life, as labours travelled to the new industrial towns from the rural Wales, England and Ireland (Jenkins 1975). Between 18th and early 20th century, Welsh coal, steel and iron industries expanded rapidly due to the rising worldwide demand, and Welsh industry and agriculture profited with full employment.

3.2 A pattern of economic development takes shape

By the beginning of 20th century, Wales had already developed an export-oriented economy servicing England and newly industrialised countries abroad. This was especially the case for coal, e.g. in its peak year of 1913, 65% of Welsh coal output was exported to the outside world (Jenkins 1975). This left the Welsh economy particularly vulnerable to overseas competition and changes in the international trading context. As quickly became apparent during the interwar period (1918 – 1939), when the demand for Welsh coal declined sharply because of the growing importance of oil, and the effects of foreign competition (especially from the USA) on the steel, iron and tinplate industries. As a result unemployment rose steeply in Wales, standing at 22.3% in 1937 as compared with 10.6% for Great Britain as a whole (Wanhill, 1980).

As a number of scholars have argued, in comparison with what happened in England and industrialising countries elsewhere, early industrialisation in Wales appears to have been driven largely by administrative and organisational innovations, rather than by the technological innovation. Much of the capital invested came from outside Wales e.g. England and took advantage of the large supply of low-paid labour in Wales. These outside investors were rarely interested in improving worker productivity through technical change (Williams 1983), and as a result Welsh economy failed to diversify (Lovering 1983). Therefore, *the whole process of early industrialisation was something done to Welshmen rather than by Welshmen* (Hobsbawm 1969), and the Welsh economy was controlled by a few magnates (in form of coal / iron / slate mine owners and landlords), and was forced by external capital and external demand. (The) *increased economic productivity, resulting from exports of raw materials.... gave rise to a peripheral capitalism which was unable to*

generate innovations and was dependent upon decisions coming from the outside (Furtado, 1974).

3.3 The Decline of Welsh Coal and Steel Industries

Welsh economic problems halted temporarily by the outbreak of WWII between 1939 and 1945, and during the boom period of 1947 to 1957. The demands for coal and steel rose again in order to support the war and post-war construction. As a consequence of government control during the wartime, the coal industry was nationalised in 1947, iron and steel in 1949. The shift of ownership paved the way for government investment in modernising these industries in order to survive. Nevertheless, in the immediate post war (WWII) period the Welsh economy remained dominated by the traditional industries of agriculture, coal, iron, steel, and their dependent construction and transport activities.

From the recession of 1958 onwards, Wales was to witness the renewed decline of its coal industry (figure 3), the result of the competition from alternative fuels, e.g. oil and nuclear power and natural gas, poor economic performance in terms of profitability and productivity compared to overseas coal producers, and prolonged industrial actions in the 1970s and 1980s. Least efficient pits were rapidly closed, which had devastating result for the South Welsh coalfield. The number of pits declined from 118 in 1960, to 51 by 1973, and subsequently to 2 deep mines and 50 small mines in 1994 when the industry was re-privatised. Its workforce shrank from around 87,000 in 1960 to only 10,200 by 1987 (George et al. 1988). By 2009 just 14 coal pits were operating in Wales, employing around 860 people, most of them with annual output under one million tonnes (Coal Authority, 2009).

A similar pattern can be seen in the case of the steel industry, only with slightly better result. Since 1930s, the British government played an influential role in the development of the Welsh steel industry, with some key decisions (e.g. to locate a strip mill at Ebbw Vale) considered to be political rather than economic (Wanhill 1980, Baber and Mainwaring 1988), affecting the industry into the following decades. The industry was nationalised in 1949 but de-nationalised in 1952, only to be re-nationalised again in 1967. During this period, massive investment was put into the Welsh steel industry. By the mid-1960s, the overall steel production was centred at five integrated steelworks in e.g. Talbot Port in south Wales and

Shotton in north Wales. The annual steel production in Wales reached around 8.5 million tonnes between 1965-73. However, after two worldwide oil crisis and the three-month steel strike in 1980, the British steel industry as a whole lost its competitiveness to rivals in West Europe, Japan, South East Asia and Latin America. The steel production in the Welsh plants dropped to, but stabilised at, an annual output of 5 million tonnes from 1981 onwards. Some 50,000 jobs were lost in the industry between 1974 and 1984 (Baber and Mainwaring 1988).

British Steel was privatised in 1988, and subsequently merged with the Dutch steel producer Koninklijke Hoogovens to form the Corus Group in 1999. Later in 2007, the Corus Group was taken over by the Indian Tata Steel. In Wales, only plants in Talbot Port and Llanwern have survived.

3.4 Regional policy intervention and the development of the manufacturing Sector

The history of the British government's regional policy interventions in Wales can be traced back to the interwar period and the Special Acts of 1934 and 1937, which sought to promote diversification of the Welsh industrial base, as a safeguard against over-specification (Wanhill 1980). The 1944 White Paper on Employment Policy also set the tone for regional policy in Wales in subsequent decades, *i.e.* to maintain a stable and high level of employment.

From 1945 onward, a succession of regional policies, *e.g.* the 1945 Distribution of Industry Act and the 1947 Town and County Planning Act, stressed the need to diversify the industrial base through influencing the location of the new enterprises. Development Areas (previously Special Areas) were established in south Wales to attract inward investment to build new factories and branch plants, and a number of major international manufacturers including Ford and Johnson & Johnson pharmaceuticals were persuaded to open plants. Indeed, by the 1960s one in three jobs in Wales was in manufacturing (including the steel industry) (McNabb & Rhys 1988).

Throughout the 1970s more investment followed, including a growing influx of foreign direct investments (FDI) from USA, Canada and other European countries, followed by Japanese companies in 80s and Korean companies in 90s. Among these new manufacturing

establishments 43% were branch plants/subsidiaries of existing firms, with over 50% of them having head offices outside the region, *i.e.* either overseas or other UK firms. The branch plants became more and more important for Welsh manufacturing sector, and accounted for around 70% of all manufacturing employment in Wales (McNabb & Rhys 1988), most of which was concentrated in the engineering, metal manufacturing, electrical and instrument engineering, vehicles and oil sectors.

By the early 1970s, Welsh economy had been experiencing a significant structural transformation, shaped by (1) a dramatic decline of the traditional coal and steel industries; (2) a continuing decline in agricultural employment; (3) a growth in manufacturing and service occupations, and (4) a substantial increase in female employment. The overall result showed a narrowing of the difference between the economic structure of Wales and that of the UK (Lovering, 1978). The Welsh economy had become relatively more prosperous with a reversal of previous outward migration, and the differential in unemployment rates had diminished remarkably between Wales and the UK.

However, the mid-1970s also saw the first signs of the decline in the Welsh manufacturing. A trend that has continued to this day as the Welsh economy has struggled with the changing pattern of threats and opportunities thrown up by European integration, and the broader overarching processes of globalisation and liberalisation international trade.

Even though the steel and the linked industries contributed the single most significant manufacturing job losses in the region, the problem also laid with the fact that the newly established manufacturing bases in Wales failed to expand enough to absorb the resources set free from the traditional industries. Many new enterprises which were expected to be part of Welsh manufacturing sector until well into the next century have also been lost (McNabb & Rhys 1988). By 1997 manufacturing industry accounted for only 27.9% of Welsh GDP but this fell further to just 17.9% in 2007, while employment in the manufacturing dropped from 208,200 in 1998 to 161,500 in 2008 (StatsWales²). Many see this as proof of the long-term failure of regional policy in Wales since 1930s.

² <http://www.statswales.wales.gov.uk>

As Wanhill (1980) stated, the regional policy of diversification, in practice, has turned out to be one of trying to capture as much new development as possible. Cajoling from the government has resulted in some poor location decisions. There has been little attempt on the part of policy-makers to evaluate the motives and appropriateness of enterprises wanting to locate in Wales, and experience has shown that some investors have been more concerned with their aid payments than with production, whilst others have collected their subsidies and very quickly disappeared.

Many early branch plants in Wales were characterised by (1) a strong export orientation, e.g. only 4% of their output went to other firms in Wales (Lovering 1978); (2) the employment of un-skilled labour, particularly increasing numbers of female employees in the light assembly industries; and, (3) as sub-ordinate corporate units branch plants employed a very low proportion of higher management and R&D personnel, and as a result had little autonomy over decisions concerning employment and investment (Davies and Thomas 1976). The heavy reliance of Welsh manufacturing industry on branch plants has exposed the region during the economic downturns, e.g. between 1966 and 1984, 57% of all manufacturing jobs lost in Wales were in branch factories.

From the history of the coal and steel industries to the rise and decline of manufacturing, one can see that much in the pattern of Welsh economic development has remained unchanged, i.e. it has been marked by a (i) heavy reliance on external investment, e.g. FDI, public funding from UK government and EU; (ii) strong export orientation; (iii) workforce dominated by low-skills, low value added, and low rates of participation (Jones 2000), and (iv) weak history of indigenous technological innovation. More fundamentally some have questioned: “*whether was there a Welsh economy after all* (William 1983)”, given the historical reality that most of the country’s transport and economic links run from east to west, rather than north to south: linking South Wales with Bristol and Birmingham, and North to Merseyside and Liverpool.

4. The current economic context and devolution in Wales

Entering the 21st century, Wales remains as one of the poorest regions in the United Kingdom. Indeed, as the Table 1 shows, the prosperity gap between Wales and UK average

has actually widened in recent years. Moreover, since 1999 West Wales and valleys have qualified as European Objective One Areas (with a GPD of 75% or less of the European Average).

Table 1. Wales' Gross Value Added (GVA): 1990 – 2008 (Source: Statswales)

Year	£ million	£ per head	Index of £ per head (UK=100)
1990	20,990	7,335	85
1995	26,388	9,135	84
1998	29,787	10,273	79
1999	30,923	10,661	77.4
2000	32,080	11,036	77.1
2005	40,514	13,717	75.7
2007	44,263	14,853	74.4
2008	45,610	15,237	74.3

Today, the economic structure of Wales bears the stamp of its industrial past, in term of not only the nature of the industries and occupations but also the type and ownership of establishments prevalent in Wales. As the Figure 3 shows, the Welsh economy is heavily dominated by the public and service sectors. In 2007, the public sector accounted for 29.4% of Wales' Gross Value Added (GVA) and employed 386,700 workforces (Statswales 2010). It is expected that, in the coming decade, the public sector will continue to play a major role in sustaining employment and incomes in Wales. However, given the UK government deficit reduction plans, considerable uncertainty currently surrounds future level of public expenditure in Wales.

As heavy industry and manufacturing have declined, the service sector (e.g. tourism, catering, retailing, transport and communications, banking, insurance and the growth industries such as media, consultancy and property development) has significantly expanded in recent decades. Its share of Welsh overall employment grew from 25% in 1971 to 31% in 1985 and 46% in 2007, and accounted for 42% of Welsh GVA in 2007 (George and Rhys 1988; Statswales 2010). Nevertheless, in common with manufacturing, many of

the jobs created in the service sector (such as call centre jobs in the banking and finance) are low skill and poorly paid.

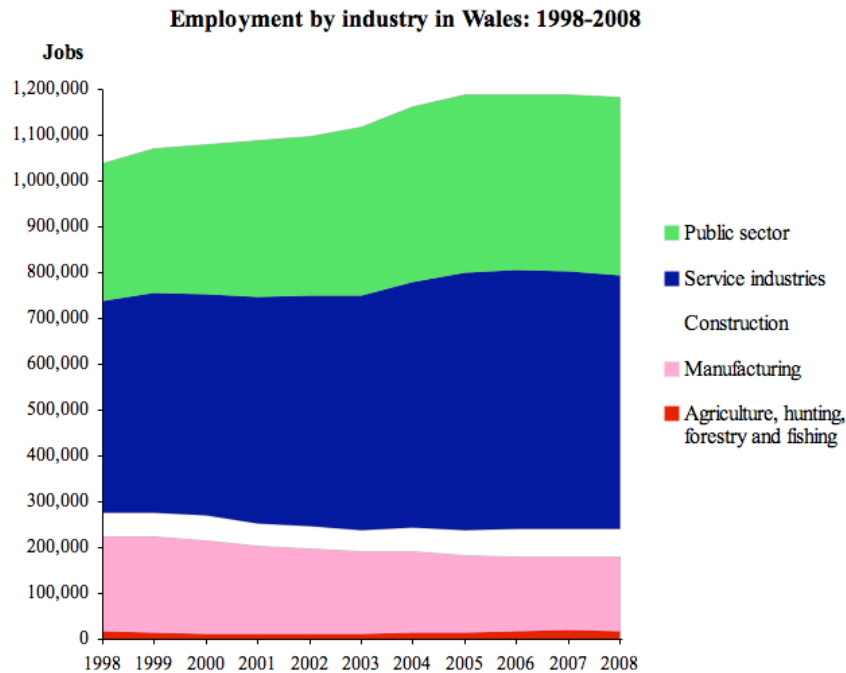


Figure 3. Employment by Industry in Wales (1998-2008)

Prior to the current recession, the only traditional industry which performed well in Wales was the construction sector. Its output steadily increased from 5.5% of Welsh GVA in 1998 to 7.1% in 2007. In the current economic climate the prospects for the sector are much more uncertain, although it is still expected to play a key role in the prospective transition to a low carbon economy in Wales, as transforming the existing housing stock and building new homes to low carbon standards are central tenants of WAGs energy policy (WAG, 2010).

4.1 Welsh Devolution

Devolution in Wales took place after the 1997 Welsh Devolution Referendum³ with an extremely thin majority vote (50.3% to 49.7% at a turnout of 51.1%) in favour to create an

³ This was the second referendum held in Wales over the issue of devolution, and the first one was in 1979 with four in five Welsh voter rejecting the idea.

assembly for Wales with devolved power. In 1999, the National Assembly for Wales (NAW) was elected with 60 Assembly Members (AM), sited in the Welsh capital of Cardiff⁴. The NAW took over most of the powers from the post-WII establishment - Welsh Office and the Secretary of State for Wales⁵. Under the Government of Wales Act 2006 (the then Act 1998), the Assembly has power to formulate subordinate legislations (in contrast to primary legislation), known as Assembly Measures which are subject to the veto of the Secretary of State or the UK Parliament. The devolved areas of NAW responsibilities spread into 20 fields including health, education, economic development, rural affairs, culture, environment, housing and local government etc., although it cannot raise any revenue of its own in principle. Currently, the Assembly is at its third term with a coalition administration between Labour Party and Plaid Cymru.

The creation of the National Assembly for Wales was a result of the manifesto commitment by the Labour Party for the 1997 general election, and was justified on the basis to help bringing government closer to the people in the nation. In concept, the Welsh devolution was regarded as a process rather than an event⁶, so the settlement introduced in 1997 was not final, and more powers have been transferred to the NAW over time.

The passing of the Government of Wales Act 2006 has set a new agenda for Welsh devolution. Key provisions made under the Act 2006 are to:

⁴ Cardiff was selected the capital city of Wales in 1956, largely because of its inherited complex of public buildings in Cathays Park (Lovering 1998).

⁵ The Welsh Office was established 1964 for implementing government policies in Wales, and headed by the Secretary of State for Wales, a cabinet position promoted from the post of the Minister for Welsh Affairs in the same year. The Welsh Office was disbanded in 1999 upon the establishment of the NAW. Currently the Secretary of State for Wales has responsibilities to ensure that the interests of Wales are fully taken into account by the UK Government in making decisions that will have effect in Wales, to represent the UK Government in Wales, and to ensure the passage of Wales-only legislation through Parliament (Department for Constitutional Affairs 2005).

⁶ "Devolution is a process and not an event" was a statement introduced by Ron Davis who was credited as the "architect of devolution" in Wales.

- Dismantle the previous constitutional settlement, and create three separate bodies: the Welsh Assembly Government (WAG) resuming executive power and headed by First Minister; the National Assembly for Wales as the legislature, and the National Assembly Commission (NAC): a corporate body providing support functions to the Assembly.

- Provide a mechanism to enable legislative power to be delegated from the UK Parliament to the Assembly by means of Assembly Measures (which is the equivalent of primary legislation) in those devolved areas that is listed as "Fields" in Schedule 5 of the Act.

- Designate the Assembly the right to hold a future referendum on full legislative powers similar to those enjoyed in Scotland. A Convention has been carried out to test public opinion and determine whether Wales is yet ready for referendum to be held in time for the new Assembly elected in 2011.

- Require Welsh Ministers to make a scheme setting out how they propose, in the exercise of their functions, to promote sustainable development (Section 79).

Following the 2007 Assembly election, the Welsh Assembly Government (WAG) was formally established. It makes decisions, develops and implements policies, exercises executive functions, makes statutory instruments and enacts Assembly Measures on certain matters. WAG's decisions and policies are subject to be scrutinized by the Assembly members in the NAW who also hold Ministers to account, approve budgets for the WAG's programme.

The devolution has forced Welsh politicians and civil servants undergoing 'a sea change' and switching role from policy-taker to policy maker. Since its establishment in 1999, the National Assembly for Wales and its executive body have built up a reputation for being open and transparent as never before, gave great emphasis to consultation and opened up policy-making process to not only the business groups but also cultural and voluntary

sectors (Mackay 2003; Loughlin and Sykes 2004, Shortridge 2009), which is, nevertheless, against the drawback of a general lack of public awareness on the Assembly's workings (All Wales Convention 2009).

Devolution is now considered irreversible, and a majority of Welsh people (some 62% in 2003) accepted the Assembly as the legitimate government of Wales (Loughlin and Sykes 2004). A new political, institutional and policy structure has been established in Wales, which consists of a "multi-level governance" involving Cardiff, Westminster and Brussels. The devolution has led to the re-discovery of Welsh identity and core values that were considered to be more 'communitarian' and 'egalitarian' and less 'entrepreneurial', derived largely from the nature of the Welsh economic past (Loughlin and Sykes 2004).

As devolution continues to evolve in Wales, it not only brings the government close to the Welsh people, as justified by the 1997 Labour Manifesto, but also provides a genuine opportunity that, for the first time in hundreds year, the Welsh interests and values are at the central point of the policy-making processes which concern with Wales

5. Wales low carbon ambitions: targets and policy discourse

Despite the significant constitutional changes brought about by devolution, energy policy remains largely a reserved matter in Great Britain with responsibility resting with the central government in Westminster. Moreover, unlike Scotland, Wales does not have its own Climate Change Act. However, Welsh Ministers do have a duty to report on climate change objectives, emissions, impacts and priorities to the Welsh Assembly and WAG does have devolved powers in a number of key areas relating to energy policy.

Moreover, rather than simply acting as a 'policy taker', WAG has sought to carve out an active and distinctive role in relation to climate change and energy issues, establishing ambitious targets and objectives which in many cases exceed current UK and international commitments. These have included, for example, commitments for Wales to:

- Reduce its use of carbon-based energy by 80-90%, resulting in a similar reduction in greenhouse gas emissions.

- Make annual 3% reductions in greenhouse gas emissions in areas of devolved competence from 2011.
- To become a net exporter of renewable electricity, aiming to renewably generate up to twice as much electricity annually as is consumed in Wales today by 2025
- Build all new buildings to meet ‘zero carbon’ standard from 2013
- One hundred thousand micro heating systems installed per year by 2020
- Two hundred thousand micro electricity systems installed per year by 2020

These targets and objectives have been set out in a series of reports and policy documents over the last three years.⁷ Our initial analysis (of these documents together with speeches and communications with senior WAG Ministers) points to the emergence of a distinctive Welsh transitions narrative over this period. Four interwoven elements are apparent within this narrative: i) Wales’ historic responsibility and exemplar role; ii) sustainable development and Welsh identity; iii) Wales comparative advantage in renewable resources; and, iv) the importance of capturing the economic and social benefits of the transition to a low carbon economy for Wales. Each of these is discussed briefly below.

5.1 *Historic responsibility*

Just as this paper traced Wales industrial history, much of the current Welsh policy discourse is framed by an explicit acknowledgement of the role that Welsh coal, and heavy industries, played in the vanguard of the transition to the carbon economy. However, this historic responsibility is re-cast in terms of an ambition to once again take an internationally leading role in the transition to a low carbon economy.

⁷ These have included: Low Carbon Revolution – The Welsh Assembly Government Energy Policy Statement (2010); Bioenergy Action Plan for Wales (2009); Wales Climate Change Strategy (2009); National Energy Efficiency and Savings Plan (2009); Capturing the Potential: A Green Jobs Strategy for Wales (2009); Ministerial Advisory Group on Economy and Transport’s report on “The Energy Sector”; One Wales: One Planet (2009); Renewable Energy Route for Wales(2008)

“Having provided much of the coal that drove the industrial revolution, we believe Wales can once again take the lead in working to create a low-carbon sustainable society.” (Climate Change Commission for Wales, 2009)

“Wales once led the world in carbon-based energy. Our goal is to do the same for low carbon energy.” (Welsh Assembly Government Cabinet, March 2010: Cabinet forward to Low carbon Revolution)

Moreover, this is not just a case (as with so many nations) of wishing to be internationally competitive, rather there is a clear sense that what is important is the distance travelled and the opportunity to play an exemplar role particularly for the newly industrialised and developing world. As the then First Minister of Wales argued:

“The question is how can you convert a heavy industrial economy into a low carbon economy, and the distance travelled is much much greater and the fear or making the change is much greater quite rightly because so much of your economic asset are tied up in high carbon use or high green house gas emitting rust belt smoke stack traditional heavy industries. So its quite a jump if we can do it, so pulling it off successfully involves a very big journey for us and it therefore it becomes perhaps much better in talking to the rest of the world” (Rhodri Morgan, 2009)⁸

5.2 Sustainable development and Welsh identity

Linked to this exemplar role is a desire to forge a new post-devolution national identity for Wales embedded in the Assembly’s commitment to promote sustainable development. Unlike energy and climate policy at a UK level, the Welsh policy discourse places climate change very much in the context of sustainable development.

⁸ Based on an interview took place in 2009

“In the fight against climate change, Wales should be in the forefront of the transition to a low-carbon economy. We are proud to be among the small number of governments worldwide to have sustainable development as one of the core principles within its statute. This distinctive duty gives us an opportunity to develop in ways which meet the social, economic and environmental needs of the Welsh people, now and in the future. Sustainable Development, therefore, is a key overarching priority of the Assembly Government.” (Jane Davidson, Minister for Environment, Sustainability and Housing, speech to LCRI Annual Conference, 26 November 2009)

Whilst Wales can no longer see itself as a nation of coal miners and steel workers, post-devolution (for its policy elite at least) sustainability is increasingly part of its national identity.

5.3 Comparative advantage

Underpinning WAG’s ambition to rapidly decarbonise energy production is a belief that Wales is well endowed with renewable energy resources and indeed, by virtue of its geographical location and climate, it possess a natural advantage in areas such as wind and marine energy. In its Renewable Energy Route Map for Wales (2009), WAG estimated that up to 14TWhr per annum of renewable energy could be produced from the marine resources by 2025 - allocating a notional half the output of any major Severn barrage to Wales and half to the south west of England. With regard to wind, over the past 10-15 years some 300MW of wind turbines have been constructed onshore in Wales, with one offshore wind farm (60MW) at North Hoyleall. It is believed that if all potential were explored in full, wind-farms within the TAN 8 strategic search areas could produce up to 2500MW of capacity: three times the existing TAN 8 indicative target for 2010. This could create almost 7TWhr per annum from onshore wind by 2015 – almost a third of Wales’ current electricity demand. Major new offshore wind projects could add at least another 3 TWhr annually.

Moreover, policymakers and politicians point to a growing capacity for energy research and development in Wales as well as experience past energy transitions to support their case.

We are blessed with a large range of the relevant natural resources; we have a

growing body of R&D expertise in the field and an excellent record over the last century of being at the forefront of previous successful energy transformations-associated with coal, oil, gas and most recently wind and biomass power.” (Jane Davidson, Minister for Environment, Sustainability & Housing Welsh Assembly Government, February 2008, Renewable Energy Route Map for Wales, p 4)

5.4 Capturing the economic and social benefits of transition

In addition to seeking to contribute solutions to the global challenges of climate change, the Welsh transitions narrative is also firmly built upon an expectation that action to meet carbon reduction objectives will also help to solve Wales’ entrenched social and economic problems: creating employment and economic opportunities, reducing fuel poverty and hence improving health and wellbeing for many of the nation’s poorest communities.

“Our future well-being, both material and social, will be dependent on achieving sufficient supplies of affordable low carbon energy. This move to a low carbon economy is an essential part of our commitment as a Government to sustainable development. Done successfully it will strengthen our economic well-being, improve the environment and help address key social issues such as fuel poverty

There is already the potential in Wales for some £50 billion of investments in large renewables and other low-carbon electricity projects alone over the next 10-15 years. We will also be investing heavily over the next years in domestic energy efficiency, community-scale renewables and alleviating fuel poverty with the prospect of attracting further significant investment into Wales through the new Wales Strategic Energy Performance Investment Programme, arbed. All this will bring opportunities for new jobs and skills across Wales and will strengthen the steps we are already taking to regenerate communities and improve housing” (Welsh Assembly Government Cabinet, March 2010: Cabinet forward to Low Carbon Revolution)

Indeed WAG’s recent Energy Policy Statement (2010) singled out action on the existing housing stock as **the** opportunity for a Welsh transition to low carbon economy. As explained

(WAG 2010), *Welsh housing stock currently has a relatively poor energy performance.... Tackling this backlog of hard-to-heat homes will create jobs, encourage skills, improve local areas, ...directly reduce fuel poverty* and carbon emissions. According to the study of 'Wales' Ecological Footprint – Scenario to 2020' (Dawkins et al 2008), housing accounts for 25% of Wales' total ecological footprint, the largest single contributor; only small proportion of the current 1.3 million homes in Wales have a full set of energy efficiency measures e.g. double glazing and cavity wall insulation; 30% of dwellings were pre-1950 built; nearly 40% of households were off the gas network, and roughly 90% of homes which will exist in 2020 are already built. Therefore, Wales needs to address not only new homes but also its existing housing stock, which could present a bigger challenge, in order to achieve its annual 3% reduction in carbon emission.

6. Regional innovation systems and the transition to a low carbon built environment in Wales

Promoting the transition to a low carbon economy, and built environment, in Wales will of course require more than just a new policy discourse or even substantial new investment investments in R&D. Attention is also required to fostering new networks and supply chains, creating new markets and ensuring that appropriate economic and policy drivers are in place to support the growth of consumer demand and indigenous entrepreneurships. This is particularly the case if the economic and social benefits of any transition are to be captured within Wales.

As noted above this paper forms part of the initial work for the Innovation, Technology Deployment and Market Development Work Package of the LCRI/WEFO Convergence Energy Programme's Low Carbon Built Environment Project. The purpose of this work package is to develop insights and recommendations regarding how industry, academia and policymakers can more effectively promote the transition to a low carbon built environment in order to capture the economic, social and environmental benefits for Wales.

Drawing upon insights from the innovation and technology policy studies literature we will map and characterise the emerging Low Carbon Built Environment innovation system in Wales. Over the next three years, through a combination of case study analysis, survey,

workshops and consultations, we will then work with key stakeholders to: articulate a clear vision; facilitate demonstration projects and niche applications; enhance supply chains; and identify drivers and barriers to rapid market deployment of the technologies.

The principal outputs of the work package will be a series of stakeholder workshops and written reports setting out a clear vision for the future development of a low carbon built environment innovation system in Wales.

7. Reflections and conclusions - challenges facing the governance of the low carbon transition in Wales

This paper has sought to provide an initial analysis of past energy and industrial transitions and patterns of economic development in Wales, and to explore the emergence of a distinct Welsh transitions narrative, in order critically reflect upon the long run challenges facing the transition to a low carbon economy from a Welsh perspective.

If Wales is to learn the lessons of its industrial past it is clear that future policy will need to strike a careful balance between efforts to exploit its comparative advantage in renewable resources through attracting inward investment in low carbon technologies and renewable energy production, and the need to foster indigenous innovation and entrepreneurial activities.

Meanwhile, Wales has one of the highest rates of carbon emissions in the world (NAW 2008). The biggest emitters in the region are its heavy industries including Corus steelworks at the Port Talbot. It will be irresponsible, socially and economically, to move these industries out of the region in order to meet the carbon reduction target, given the reality that the steel industry has contributed significantly to the Welsh economic development in the past century and has become an anchor of Welsh economy. Therefore, the challenge facing Wales is how to decarbonise its heavy industry⁹, and engage the heavy

⁹ Corus has invested £60m into the Basic Oxygen Steelmaking (BOS) plant Energy Recovery project at Port Talbot Steelworks. This project is on track for completion in 2010 and will reduce the sites' annual carbon emission by around 240,000 tonnes (CBI 2010).

industry into the low carbon transition while sustain, if not improve, the social and economic contribution for Wales.

In order to fully capture the economic and social benefits of transition, particularly in terms of employment and economic opportunities, WAG will need to ensure the development of a strong regional innovation system, through mobilizing investment in R&D activities, building local supply chains, improving skills and training, etc. Moreover, it seems inevitable that for the next decade at least the WAG will have to seek to achieve all of this during a period of severely reduced public expenditure and limited capital availability.

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Annex I: A Summary of UK and Wales' low carbon related policies

By the UK Government	By the Welsh Assembly Government
<p>The Energy White Paper 2007 UK Climate Change Act 2008 Planning Act 2008 Energy Act 2008 and 2010 Utilities Act 2000 / Gas Act 1986/ Electricity Act 1989 Carbon Emissions Reduction Target 2008-2011 (amended 2009) The UK Low Carbon Transition Plan (2009) National Strategy for Climate and Energy: Transition to a Low Carbon Society (2009) Carbon Reduction Delivery Plan (2010) The UK Renewable Energy Strategy (2009), National Renewable Energy Action Plan for the UK (2010) The UK Forestry Standard and Guidelines Building a low carbon economy: a framework for the development of clean coal (2009) Planning and Energy Act 2008 Building regulations 2001 and 2006 Code for Sustainable Homes –Technical Guidance UK Definition of Zero Carbon Homes The Standard Assessment Procedure (SAP) Warm Homes and Energy Conservation Act 2000 The Transport Carbon Reduction Delivery Plan (2010) Community Energy Saving Programme (2009) Feed in Tariffs scheme (2010) CRC Energy Efficiency Scheme (2010) Smart Metering for electricity and gas Renewable electricity financial incentives Heat and Energy Saving Strategy Low carbon industrial strategy (2009) The Sustainable Farming and Food Strategy (2002)</p>	<p>One Wales: One Planet – the Sustainable Development Scheme Wales Climate Change Strategy (late 2010) A Low Carbon Revolution: Wales' Energy Policy Statement Planning Policy Wales (2002) The Energy Wales Route Map (2005) A National Energy Efficiency and Savings Plan (2010) Technical Advice Note 8 Planning for Renewable Energy The Renewable Energy Route Map Bioenergy Action Plan Woodlands for Wales – our strategy for Welsh woodlands and trees (2009) Local Government (Wales) Measure 2009 Sustainable Homes: a National Housing Strategy for Wales Building Regulations Wales Planning for Sustainable Buildings (2009, TAN 22) Technical Advice Note 12 – Design The Home Energy Efficiency Scheme (2001) Welsh Housing Quality Standard (2002) Better Homes for People in Wales: a National Housing Strategy for Wales in 2001 Fuel Poverty Strategy (revised in 2009) Technical Advice Note 18 – Transport Wales Transport Strategy (2008) The 4th Regional Transport Plans 2010-11 Environment Strategy Action Plan 2008-11 Wales' Rural Development Plan 2007-13 Farming, Food & Countryside - Building a Secure Future (2009)</p> <p><i>[Note: Those policies in yellow shadow are not published yet but expected.]</i></p>