

Green Growth

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The idea that growing and greening our economy are at odds, that we must plump for one or the other, is a classic false choice. In reality, as we invest to decarbonise our economy, we also grow it. Green investments – whether in resource efficiency or substitution for polluting processes – create jobs, raise incomes, and prop up demand. They produce *green growth*.

The years to come may well be different. It won't just be that we *can* have green growth; it will probably be that we can *only* have green growth. On market fundamentals, now and into the future, the prospects for high-carbon growth do not look good. This chapter looks at why this is – and why, perhaps more so than ever before, this is the green economy's moment.

This chapter advances a twin argument: a greener economy would enjoy lower resource costs and higher resilience to shocks. It would protect demand and investment when global prices rise, and thereby protect jobs and livelihoods. It would provide a more stable, stronger economy, less likely to topple into recession or suffer lost periods of growth. It is how we raise standards of living without creating systemic risk, and how we tease out growth in an age of scarcity. At one time, the green sector may have merely been a strand of growth. Now it is the new frontier. The raw economics are telling us this has to be our first priority, our prime strategy for growth. It is, perhaps, all there is.

Winds from the East

In early 1999, a barrel of oil cost just over US\$10.¹ In March that year *The Economist* ran a leader article titled 'Drowning in Oil', contemplating the dangers of an oil price that could sink too low. Plainly, that particular danger was averted. After a nine-year surge, the barrel price of crude hit US\$147 in July 2008. Though recession in the first quarters of 2009 cooled demand, the price was back over US\$100 by January 2011.² For the first time in the post-war period, energy and other commodity prices are abnormally high for this point of a recovery. Usually the cost of basic materials falls in real terms for two years after the recovery begins, boosting real incomes and supporting

spending.³ This time we have a different phenomenon in the old developed regions of Europe, Japan and America: the ‘squeezed middle’. Not only have we missed the boost to incomes and spending, but high energy and material prices have been pummeling a recovery already weakened by financial crises and the legacy of debt. The contrast is huge, and has enormous consequences for the future. We must grapple with the implications.

Since 1970, there have been four big global recessions. As noted earlier, if we take the first three, energy prices in the two years after the US recession ended were flat; on average, the rise was just 1 per cent. Allowing for the general rise in earnings and other prices, the cost of energy fell in real terms, bringing down petrol prices, cutting household bills, and raising disposable income. Twenty-four months after the 2008 financial crisis struck, energy prices were up 63 per cent. For non-energy commodities, including food, the past rise during those three global recoveries averaged just 11 per cent. This time it was nearly five times that, at a fraction below 52 per cent.⁴

It is sometimes claimed that this is due to speculation. But this is at most a contributory factor. As the International Energy Agency finds, ‘commodities not traded in exchanges experienced similar fluctuations and price surges’ in the latter half of the 2000s.⁵

The real cause is the extraordinary growth of Asia. This has a direct impact through the needs of manufacturing for energy and metals, and an indirect impact through the new demand for cars and other high-carbon consumer products. It has also been impacting heavily on food. As wealth flows to the new middle classes of China and India, people are eating more, and eating differently. This is nothing to regret. The pace at which living standards have improved in recent years is fantastic. But there are inevitably consequences for resources; meat consumption especially is on the rise, with well-known spillover effects for arable products – a kilo of meat takes many more kilos of grain to produce. One mainstream forecaster expects an 85 per cent increase in global meat production by 2050.⁶

In 1975, China accounted for barely over 5 per cent of global primary energy consumption. By 2010, it used a fifth of world energy.⁷ The impact on trade was even greater, as China swung to being a substantial net importer of fuels. China accounted for less than 1 per cent of fuel and mineral product imports in 1985, but 12 per cent by 2010.

The trend is not slowing. Over the next twenty-five years, 60 per cent of new energy demand will probably come from China, India, and the Middle East, and total demand will be up by a third.⁸ Almost all net oil demand is driven by the transport sector in emerging economies.⁹ A thousand new cars

join China's roads every day, and in the next two decades the global car fleet is forecast to double, meaning a car population of 1.7 billion by 2030.¹⁰ The global middle class, meanwhile, is going to more than double, by most estimates swelling from around 2 billion today to 5 billion in 2030.¹¹ Again, this is in one sense an amazing development, banishing poverty, widening opportunity, and helping to spread democracy and the rule of law. But it does also mean an unprecedented demand for physical resources. Billions and billions of consumers now have the purchasing power for travel, air conditioning, meat, and many other high-carbon comforts. In that context, it is very hard to see how prices will be anything other than high and volatile.

Shock-proofing

The problem is not just demand. Even if global growth slows – as it did in 2012, and is forecast to do in 2013 – we need to worry about supply. As oil prices rocketed upwards in the 2000s, supplies grew at just 1 per cent a year.¹² Energy security has clambered quickly up the political agenda in many countries, not just because prices are high, but because they are skittish. Volatility is greater than at any time since the oil shocks of the 1970s.¹³ Maplecroft's short-term Energy Security Index classifies the UK as 'high risk', more vulnerable than Germany, France, and the US, and only marginally more secure than Japan.¹⁴ That reflects, at least in part, Germany's bigger stock of renewable energy, the French embrace of nuclear power, and US development of shale gas. Meanwhile, the UK has become a net importer of fossil fuels. North Sea oil and gas, experiencing one of the highest global rates of decline, cannot provide a buffer for Britain's balance of payments as it used to.¹⁵ Only Yemen and Libya saw a bigger drop in production recently, and the latter had a civil war. Our failure to adapt, to green our energy supplies and cut dependency on fossil fuels, has left us dangerously exposed to shocks.

This is not just about Russian pipelines. A far more worrying prospect is Iran intervening in the Strait of Hormuz. A fifth of the world's oil is transported along this stretch of the Iranian coastline, and there is no guarantee that tensions in the region can be contained. Furthermore, many oil producers are pumping oil at the limits of capacity. Even Saudi Arabia is producing at near-record levels, leaving little manoeuvrability when supplies tighten or demand spikes.¹⁶ When the Arab Spring broke out early in 2011, the price of crude oil soared 35 per cent in three months.¹⁷ Within limits, the economy can absorb higher energy prices. A sustained 10 per cent rise in the oil price drags global growth down by an estimated 0.2 per cent.¹⁸ But big shocks hurt. Sudden jolts can too easily throw advanced economies into recession.

Indeed, the rise of the crude oil price in 2011 was a significant factor in the global slowdown.

In the 21st century we are going to need a much more energy-resilient economy, insulated from the wavering price of fossil fuels. This isn't just an insurance policy. Shock-proofing the economy breeds confidence, supporting domestic and inward investment. This is why stability is not just a platform for growth, but a *driver* of growth. That case isn't always easy to make. Often stability brings an invisible dividend, sparing us growth we *would* have lost. Oxford Economics has modelled the impact of oil and gas shocks over the next few decades, contrasting a low-carbon scenario with 'business as usual'.¹⁹ The low-carbon scenario reduces the impact of a fossil fuel shock by 60 per cent in 2050, with transport and manufacturing particularly benefiting from the change.

Cautious pessimism

Of course, we need to be wary of forecasts. The only good forecast is of history, and it is lined with resource-scarcity prophets who have been embarrassed before. The Victorian economist W. S. Jevons was so sure that we would run out of coal that when he died lumps of it were found stuffed into every cranny of his home. Thomas Malthus famously thought that food production could not keep up with population growth, and devastating famines would break out. In the late 1960s, Paul Ehrlich of Stanford University co-founded 'Zero Population Growth', warning again that the planet could not cope with so many people on it; humanitarian disaster was inevitable, and imminent. A few years later the Club of Rome forecast that resource consumption would impose an upper limit to economic growth, coinciding with the 1970s oil shocks that rocked global confidence. In 1980, Ehrlich was confident enough to bet the economist Julian Simon that commodity prices would go up; this is now known, naturally, as the Simon-Ehrlich wager. With an agreed measure of resource scarcity, they set a ten-year period to see how the prices of copper, nickel, tin, chromium and tungsten would play out. This was a decade when the global population boomed by 800 million. Still, Ehrlich lost, and badly. After ten years had elapsed, all five metals were cheaper, leaving the Stanford professor almost us\$600 worse off.²⁰

So we ought to be cautiously pessimistic. Whatever you make of the 'genius' of markets, supply squeezes in the past led not to famine, or economic disaster, or even war. They drove innovation. In the 20th century, while demand shot up twenty-fold, the index of critical commodities sunk by almost half.²¹ We might achieve such a feat again. There may be new reserves

of productivity in agriculture, or new ways of finding and exploiting minerals. In energy the obvious candidate is unconventional gas, where rock formations are split or 'fracked' by injecting water and chemicals at high pressure to release the gas inside. Natural gas is cleaner than coal or oil, and can also be used to generate low-carbon electricity, so long as the carbon is captured and stored. However, the speed of the US exploitation of shale gas is unlikely to be repeated in more densely populated regions like Europe. The footprint of shale wells is relatively large, and environmental concerns about water pollution have already led to bans, not just in France but also in US states like New Jersey and New York. Outside the US, mineral rights usually reside in the state, rather than the landowners, reducing incentives to drill and increasing reasons to say: 'not in my back yard'. What is more, many areas (such as China) where shale may be abundant lack the water needed for fracking.

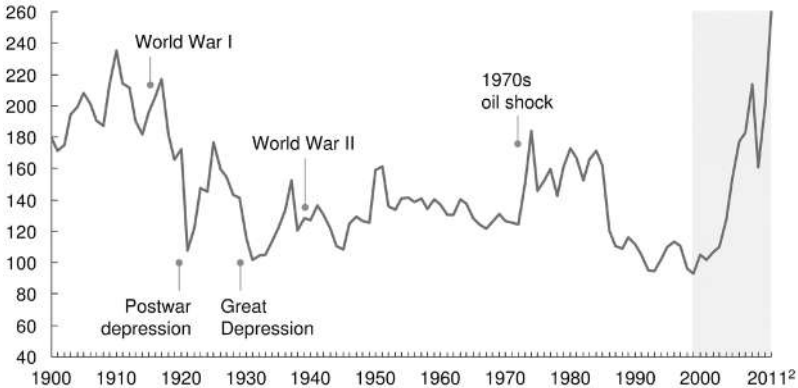
In the short term at least, we have hit what may be a commodity price speed limit: where if the rate of supply cannot accelerate, growth must slow. In the past this reflected temporary inelasticity, the lag-time between spikes in demand and new exploration or innovation. This time we may be experiencing something different: we may well be undergoing, as GMO's Jeremy Grantham has argued, a 'paradigm shift' in energy and other commodity prices. The GMO index of thirty-three commodities shows that until 2002, commodity prices were on a 110-year slide, dipping on average 1.2 per cent a year – a 70 per cent decline over the entire period.²² In the last decade that entire drop was reversed. Analysis from McKinsey warns that on current trends there is a significant risk of commodity prices remaining high and volatile, and that a completely unprecedented rise in resource productivity is needed. It is going to take an extra trillion dollars of investment, 175 million hectares of extra deforestation, 30 per cent more water, three times as much new land. And CO₂ emissions of up to 66 gigatonnes (more than twice the IPCC target), throwing the planet far beyond a 2°C temperature rise.²³

The problem is that much of the easy extraction – the open mining, the shallow drilling – has already been done. From here on resources are likely to be harder, riskier, costlier and more controversial to access: across the steppe, out to sea, under the ice cap. As the CEO at Glencore, the world's largest commodities trading company, put it: 'Unfortunately, God put the minerals in different parts of the world. We took the nice, simple, easy stuff first from Australia, we took it from the US, we went to South America and we dug it out of the ground there. Now we have to go to more remote places'.²⁵ That should not surprise us. Growth always slows after the opening stages. At first

Fig. 11.1 Commodity prices 1900–2011²⁴

Commodity prices have increased sharply since 2000, erasing all the declines of the 20th century

MGI Commodity Price Index (years 1999–2001 = 100)¹



1 See the methodology appendix for details of the MGI Commodity Price Index.
 2 2011 prices are based on average of the first eight months of 2011.
 SOURCE: Grilli and Yang; Stephan Pfaffenzeller; World Bank; International Monetary Fund (IMF); Organisation for Economic Co-operation and Development (OECD); UN Food and Agriculture Organization (FAO); UN Comtrade; McKinsey analysis

you take the best resources, the best land, the cheapest labour. After that, things get harder. You can raise productivity, invest in technology, skill up your workers; but it is a slower process. Diminishing returns may finally be setting in with commodities. Faced with this development, the safe national strategy is surely to hope for the best but prepare for the worst: to encourage resource-efficient growth. The more we save energy and the more we shift to renewables, the less dependent we are on whatever happens to fossil fuel markets. And in the immediate future, we release a badly needed wave of demand to help spur our sluggish recovery.

The great green market

After all, the green economy is no longer a cottage industry. It employs more than a million people in Britain. Across the globe there is a £3.3 trillion market for low-carbon products and services.²⁶ Governments, businesses, and individuals are buying up green goods and services at such a pace that in the UK the sector is growing at 4.9 per cent a year, and predicted to grow faster still in the years to come – 5.5 per cent by 2014–15.²⁷

What has really been firing ‘green demand’ is cost-saving. All the analyses on energy supply and demand show that the most cost-effective way to close

the gap is not to use energy in the first place. Investment in energy saving is more cost-effective than any investment in energy production.

There is also an increasing commitment to low-carbon electricity generation across the world, especially renewables. We have already passed the cross-over point when renewables investment exceeded that in fossil fuels. This is not because the costs are currently lower, but because the trajectory of cost reduction is clear. In just four years, solar panels (solar photovoltaics) have tumbled in cost from more than US\$4 per watt in 2008 to less than US\$1, and the cost is still falling, at around 10 per cent a year.²⁸ The cost of onshore wind has been coming down too. Wind is now competing, on cost, with conventional fossil fuels if the location is right. At a recent auction in Brazil, onshore wind beat conventional combined-cycle gas turbine plants on cost, offering electricity at US\$61 per MWh, 24 per cent less than the year before.²⁹

This has not gone unnoticed. China has nominated a quarter of its regions as low-carbon pilots. Ethiopia, as a low-income country, has embarked on a strategy for green growth.³⁰ Korea is powering ahead with a Green New Deal worth 10 per cent of GDP, investing in energy efficiency, recycling, and renewables, and expected to boost employment 10 per cent by 2013.³¹ China's ambitions, unsurprisingly, are on an awesome scale. In fewer than eight years it wants 100 extra gigawatts of hydropower and 200 more gigawatts of wind power.³² On top of that, its nuclear capacity is planned to rise from 10 GW to 80 GW. The Chinese are building more than twenty nuclear reactors in the time it will take us to build one, and laying 16,000 km of high-speed rail in the time it will take us to get HS2 from London to Birmingham.

It is often claimed that we should wait until the cost of green investment falls even more, or that the investments are simply too expensive. But in truth, the low-carbon future is cutting household bills even in the short term. The Department of Energy and Climate Change calculates the cross-over point at about US\$100 a barrel (and the equivalent for gas). If world prices are higher than that, then the whole portfolio of UK low-carbon policies, including energy saving and support for low-carbon generation, pay for themselves and save businesses and consumers money.

These are not fringe savings. By one estimate, UK firms could recoup £23 billion a year.³³ One vehicle assembly plant wiped 28 per cent off its energy bill in one year, saving £2.3 million. It did so with minimal investment: it turned off unused machines and repaired the holes in compressed air pipes. More and more, selling cost-savings is good business. SPI Lasers in Hedge End produces rare earth lasers that save 90 per cent of the energy used by traditional carbon lasers, now the workhorse of world metal-bashing. Meanwhile,

the lift industry is enjoying a small renaissance. The world's largest manufacturer, Otis, has just released the Gen2, and it has become its fastest-selling line ever because it uses as much as 75 per cent less energy.³⁴ The same thing is happening with LED bulbs. They consume 1 watt of electricity where 35 watts was needed before. If we want to roll out these savings more quickly, we need to make it easier for consumers to invest in energy efficiency through the Green Deal, and we need a powerful Green Investment Bank to lead business.

The green market in the UK is worth an estimated £122.2 billion a year, and it is expected to be £155 billion in 2014.³⁵ Plainly, this is now serious business. As the market in energy efficiency blossoms we are expecting significant expansion in employment in insulation alone.³⁶ Companies wanting to trumpet their green credentials are playing a bigger and bigger role too, responding both to the social responsibility of their customers and their employees. Companies that want to win loyalty have to behave like good citizens – and more and more are. Nearly 65 per cent of CEOs worldwide say their response to climate change initiatives gives them a reputational advantage.³⁷ Fewer than 25 per cent believe that such initiatives would slow growth in their industry. More importantly, nearly half of CEOs think new product and service opportunities lie in these efforts.

What is more, this is the sort of investment that sets innovation alight. In the past, the upfront-cost problem made greentech a specialist market, a preserve of the wealthy. Today, the green market is quickly creating the economies of scale to pull prices down and release full-scale competition. It is now supermarkets that are tussling for supremacy on insulation or smart meters or microgeneration. Not only is that attracting a wave of green innovation, it is making innovations a whole lot more accessible. And if we are to survive the 'paradigm shift' in commodities ahead, innovation is precisely what we are going to need.

Conclusion

There is little doubt about the trajectory of the developing world. China's growth has not stopped, and it is not going to stop. The increase in China's demand for natural resources will slow down or accelerate with the rhythm of its economy, but it will go on growing. We may be struggling through the worst economic crisis for three-quarters of a century, but emerging economies are still upping their exports, raising their incomes, and sucking in more and more commodities. For all the sluggishness of the developed world, the commodity price trends of the past decade are not about to reverse. This is supercharging the case for green growth like never before.

It will take an awesome expansion of production to bring commodity prices back to twentieth-century levels. Shale gas may take the edge off gas price rises, and help fill the hole as Germany and others go non-nuclear. But it is unlikely – at global level – to be a game-changer. On oil, there may be dips in oil prices from year to year, but the age of cheap oil now looks like a misty dream. For the next few years at the very least, we can expect a high floor price and a Saudi policy determined first to ensure that the Kingdom's budget balances. As for non-fuel commodities the prospects are none too bright. Extraction is getting harder and harder, and demand is growing faster than ever. New innovations will raise productivity, but they are very unlikely to reverse the long-term trend. The transition has happened. From now on steel and iron and copper and chemicals and other key commodities are going to cost more. If we want growth back, we simply have to adapt.

As long as high commodity prices are crimping demand, a part of our new prosperity must be created by cutting resource costs. The new markets in fuel-efficiency, renewable energy and resource-productivity are what will increase business margins, boost sales, and create jobs. As commodities veer unpredictably from one new height to another, the folly of having chosen excessive reliance on high-carbon is horribly clear. There may be a long-term role for gas with carbon capture and storage, but we mustn't make the same mistake of over-reliance on one resource again. In hard times, the worst thing the green agenda can do is slink back, awaiting the return of growth. We need, quite simply, to go as green as we can as quickly as we can.

The policy instruments have largely been laid out. The UK has a clear framework for cutting carbon in the Climate Change Act. We have the tools to encourage the shift to low-carbon transport through vehicle standards (on emissions) and subsidies for electric vehicles. The Green Deal will allow consumers to pay for energy-saving measures in their homes from the energy savings on their household bills. The Government's new Energy Bill will provide investors in all the low-carbon families of electricity generation – renewables, nuclear and carbon capture and storage of fossil fuels – with certainty by means of fixed prices in contracts for difference. Any short-term competitive difficulties for energy-intensive industries should be met with special assistance, but the EU framework will help. The prospects for US leadership have increased markedly with President Obama's second term.

In theory, all three major British parties now share a cross-party consensus towards decarbonisation. However, the danger is that differences in enthusiasm between the Treasury and the Department of Energy and

Climate Change have become exposed, and that those mixed messages worry investors about staking their money on a low-carbon future. Investors abhor uncertainty, particularly in an area where government taxes or subsidies are crucial in offsetting the failure of the market to take into account the impact of carbon emissions. Policy matters. Mood music counts. When green growth is so crucial, and is responsible for so much of the increased activity in the UK economy, ministers need to show a united front. The future is green.

Margaret Thatcher was a Prime Minister who had been trained as a scientist, and perhaps as a result was the first world leader to highlight climate change as an important global challenge. As she might have said, there is no alternative. Either we will grow in a green way, or we will not grow at all.

Notes

- 1 IEA, *Monthly Oil Market Report*, March 1999.
- 2 IEA, *Monthly Oil Market Report*, February 2011.
- 3 In 2012, as some commodity prices dipped, there was speculation that we were experiencing a commodities super-cycle, which was coming to an end. However, as J. P. Morgan's commodities head Colin Fenton warns, this may be 'confusing a temporary consumption slump linked to the shorter business cycle with the "conclusion of a multi-decade investment boom" in the natural resources industry' (*Financial Times*, 'Iron ore prices climb 60% in four months', 28 December 2012), while the IMF notes in its October 2012 *World Economic Outlook* regarding oil that 'reflecting physical market (for example, North Sea) disruptions, ongoing geopolitical risks and concern about associated supply disruptions, and expectations of stimulus in China, the United States, and Europe, the risk to oil prices is tilted to the upside'.
- 4 World Bank, *GEM commodity price index*, 2012.
- 5 IEA, *Monthly Oil Market Report*, March 2011.
- 6 PwC, World Economic Forum Knowledge Concierge: *Sustainability, Environment, and Natural Resources*, 2012.
- 7 BP, *Statistical Review of World Energy*, 2011.
- 8 International Energy Agency, *World Energy Outlook*, 2012.
- 9 Ibid.
- 10 Thomas L. Friedman, *Hot, Flat, and Crowded* (Picador, 2009); McKinsey, *A new era for commodities*, November 2011.
- 11 McKinsey Global Institute, *Resource Revolution: Meeting the world's energy, materials, food, and water needs* (2011).

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- 13 McKinsey, *A new era for commodities*, November 2011.
- 14 Maplecroft, *Energy Security Index*, 2011.
- 15 BP, *Statistical Review of World Energy*, 2012.
- 16 Bloomberg, 'Saudi Oil Output in January Was Near 31-Year High', March 2012.
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- 21 McKinsey, *Resource Revolution*.
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- 23 McKinsey, *Resource Revolution*.
- 24 Source: *ibid*.
- 25 Javier Blas, 'Commodities: Into the spotlight', *Financial Times*, 10 April 2011.
- 26 BIS, 'Low Carbon and Environmental Goods and Services: an industry analysis', June 2012.
- 27 *Ibid*.
- 28 McKinsey, 'Solar power: Darkest before dawn', August 2012.
- 29 Bloomberg, 'Wind Cheaper Than Natural Gas, Hydro in Brazil Power Auction', August 2011.
- 30 OECD, *Towards green growth: A summary for policy makers*, 2011.
- 31 *OECD Economic Surveys, Korea*, 2012.
- 32 *The Economist, Special Report on Nuclear Energy*, March 2012.
- 33 Oakdene Hollins-Defra, *The Further Benefits of Business Resource Efficiency*, 2011.
- 34 McKinsey, *Resource Revolution*.
- 35 BIS, 'Low Carbon and Environmental Goods and Services: an industry analysis', June 2012.
- 36 DECC, *Final Stage Impact Assessment for the Green Deal and Energy Company Obligation*, 2012.
- 37 PwC, World Economic Forum Knowledge Concierge: *Sustainability, Environment, and Natural Resources*, 2012.

Driving Growth through Green Innovation

Dimitri Zenghelis

Why the green time is now

The current period of low confidence and stagnating private investment presents a unique opportunity for the UK to boost employment and stimulate economic growth, while encouraging competition and innovation. By kick-starting investment now through strong, clear and credible green policy measures, policy can mobilise private savings and make green investment a safer bet for business. Such action can crowd in tax revenues and address public indebtedness. At the same time, the UK can meet tough emissions targets cost-effectively and leave a long-lasting legacy in the transition to a resource-efficient green economy.

Structural reform of the UK economy to increase productivity is essential, but it takes time. Without recovery any attempt to achieve fiscal sustainability any time soon will be unacceptably destructive, both economically and politically – as recent events in Europe have demonstrated. Enduring growth requires investment. But investment has slumped to record lows mainly because households, businesses and banks are nervous about future demand, and have responded by forgoing more risky investment in physical capital.

Figure 12.1: Fixed investment: United States (left); United Kingdom (right)¹

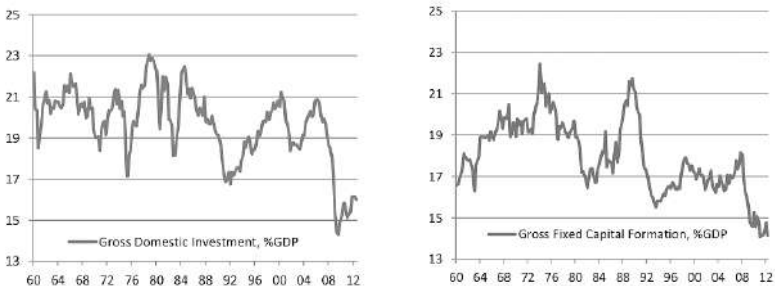
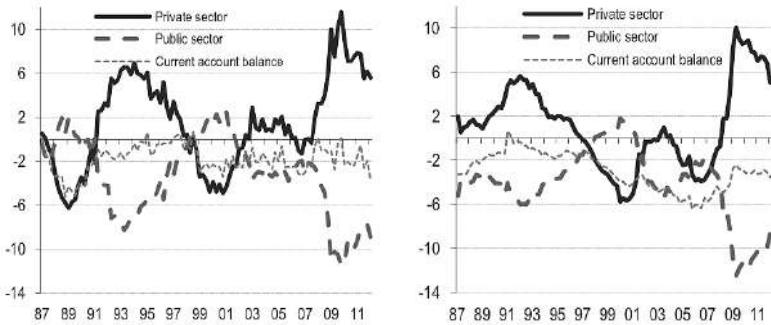


Figure 12.2: Sector financial balances (net lending): US (left); UK (right)¹



Instead, companies and households are squirrelling away private saving into ‘risk-free’ assets such as solvent sovereign bonds. As a result, annual private sector surpluses – the difference between saving and investment – have swollen to record levels over the past few years, amounting to £99 billion in 2011, equivalent to 6 per cent of UK GDP.

So how did the private sector come to accumulate such enormous saving surpluses? After the financial crash – which many governments helped fuel through excess fiscal borrowing at the peak of the economic cycle – households, businesses and banks undertook necessary and unavoidable long-run stock readjustments in their balance sheets. This required additional saving: a reduction in private spending in order to restore private sector net worth. A slowdown in growth, or even recession, was an inevitable consequence of this balance-sheet adjustment.

The problem is that many Western economies are now trapped in a classic ‘paradox of thrift’, in which greater saving and cost-cutting is the rational response to economic gloom at the level of an individual business (which also sheds labour), bank (which restricts credit) or household. But when everyone retrenches simultaneously, fear of extended recession becomes a self-fulfilling prophecy. This yields a vicious circle of low demand and low investment that affects the whole economy; and the longer recovery is delayed and capital sits idle, the more skills are lost, and the higher the misallocation of resources, making it harder to restore growth.

Desired saving has exceeded desired investment in many advanced economies to such a degree that global real ‘risk-free’ interest rates for the next twenty years have been pushed to zero and below. The collapse in US

Treasury bill rates offers the benchmark for ‘risk free’ returns (Table 12.1) but UK gilts and German Bunds are equally unprofitable assets. This is remarkable. Our savings are losing value by the day as pension funds and financial institutions pay real interest to (rather than receive interest from) governments; a truly perverse state of affairs given the need for productive investment. These low rates cannot and do not reflect a collapse in the underlying returns to capital; instead they reflect desperately depleted confidence³.

Table 12.1. Daily United States Treasury yield curve rates⁴

Date	1 m	3 m	6 m	1 y	2 y	3 y	5 y	7 y	10 y	20 y
29/10/12	0.13	0.14	0.16	0.18	0.30	0.40	0.74	1.16	1.74	2.48

With short-term interest rates close to zero, the effectiveness of monetary policy to stimulate growth is reaching its limits; and fiscal policy is tightly constrained. Some have argued that deregulation will help stimulate business activity. Deregulation is necessary in the long run, but it may not have much effect in a severely demand-deficient environment. What is needed to restore confidence is a clear strategic vision with supporting policies to guide investors. In the past, we have seen Roosevelt’s New Deal, or rearmament for war. In this case, recognising the inevitable transition to a low-carbon economy, and helping to drive forward investment in resource-efficient, innovative sectors, could both restore growth and leave a lasting legacy. As well as achieving energy security, tackling climate change, and saving consumers and businesses costs in the long run, these sectors offer long-term returns for investors. Of course, all investment and employment raises costs, by definition: resources must be paid for. And these costs will be borne by consumers, but they are part of the process of generating economic surplus and restoring economic health. It is worth bearing in mind that the simultaneous attempt to cut costs by households, businesses and banks is precisely what has prolonged this recession.

Standard macroeconomics tells us that the best time to support investment is during a protracted economic slowdown. Resource costs are low, people are unemployed and the potential to crowd out alternative investment and employment is minimal compared with when the economy is operating at full capacity in a tight labour market. In addition, although public budgets are stretched, there is no shortage either of private capital available for investment, or of investment opportunities with the potential for profitable returns. The current opportunity should not be missed.

But why green? For one thing, unlike much conventional infrastructure investment which requires large sums of public spending, private green investment can be leveraged through coherent policy signals such as standards and regulations, which costs the exchequer little, or carbon pricing, which raises revenues. Investment in the sector is credible in the long run because a transition to resource efficiency is widely recognised as inevitable. It will be transformative, creating sizable new markets in all the world's economic sectors: buildings, transport, agriculture, manufacturing and communications.

The green sector is one of the few vibrant parts of the global economy at the moment. The most recent figures published by the Department for Business, Innovation and Skills show that the UK low-carbon and environmental goods and services sector had sales of £116.8 billion in 2009–10, growing 4.3 per cent from the previous year and placing the UK sixth in the global league table. But the private sector is not investing as heavily as it could in green innovation and infrastructure because of a lack of confidence in future returns in this policy-driven sector. The lack of confidence is due to uncertainties surrounding current energy and environment policy.

The reliance on policy to drive this market has advantages in the current fragile economic environment. Cautious investors can be driven to act now by correctly priced public resources, sweeping standards, regulations and technology support without relying on private sector sentiment to drive demand. Governments can provide clarity on their vision of the future, defining outcomes and letting entrepreneurs figure out how to get there. Korea and China have understood the logic of this approach. China has moved decisively to champion high technology low-carbon growth, both in its stimulus package of 2008–09 but also in its twelfth five-year plan, which sets strong targets.⁵ China and other countries recognise that investment flows to the pioneers of the revolutions.⁶

Recognising and correcting market failures

Policies to encourage low-carbon investment would provide new business opportunities and generate income for investors. These markets are credible in the long term precisely because they address growing global resource challenges, so tapping into a fast-growing global market for resource-efficient activities. But what form should public intervention take? For all the failures of the financial sector in recent years, the market remains the most efficient way to coordinate the vast amount of information needed to match scarce resources with the things consumers want to buy. Competitive markets, free from protectionism, create the disciplines that will drive success in global trade. Markets

work best when power is diffused and information is symmetric – that is, when buyers and sellers both know what they are getting into. Markets are most dynamic when barriers to entry and to hiring people are low, and where prices reflect all the costs of production, including social and environmental costs.

But global integration and accelerating consumption have led to a growing number of market failures and missing markets, which require public intervention to become economically viable. These occur when uncoordinated markets driven by individuals pursuing their own self-interest are unwilling, or unable, to undertake the requisite investments alone. At the heart of these ‘failures’ lie information and ownership issues which prevent the setting up of a working market. These require coordinated public intervention to establish property rights and provide incentives to spur markets and foster innovation.⁷

For the most part, markets do not fail, but where they do, the consequences in terms of eroding welfare and efficiency can be dramatic. Moreover, different market failures point to different instruments, so long as the collection is mutually reinforcing. For example, without properly valuing natural assets, it is hard to prevent over-consumption and the depletion of scarce resources, especially ones that are owned in common, such as fish in the ocean, or clean air. This has distorted the development of advanced economies to make them far too hungry for such resources.

In addition to mispriced resources, policy-makers need to tackle market failures relating to information and ownership that yield insufficient research and development spending by the private sector, as investors fear that they will fail to capture the full returns to innovation because knowledge is free.

There are also a growing number of network externalities. These occur where the value of joining a network depends on how many others are on it, such as telephones, public transport, fast broadband, electricity grids and community-based insulation schemes. These increasingly require government frameworks to help firms reap increasing returns to scale by supporting new networks.

When standard economic cost-benefit analyses are not ‘fit for purpose’

So what can economics tell us about the long-run opportunities and costs of resource-efficient investment? Will we need to trade off growth in order to preserve the environment? It is clear that standard narrow cost-benefit analysis can provide only part of the story.⁸

Where non-marginal, low-probability, high-impact, potentially irreversible events such as climate risks and species loss are involved, a broad

risk-management approach to decision-making under uncertainty may be more appropriate than a deterministic cost-benefit assessment. This includes being prepared to pay a premium to guard against low-probability but possibly catastrophic events. It also means recognising the market failures listed above and the ‘co-benefits’ associated with green policies, including energy and resource efficiency gains,⁹ valuing ecosystems and biodiversity, valuing energy security, and the regulation of dirty and more dangerous technologies.

Many standard models also ignore the complex dynamics of the problem, where delaying or postponing green policies is dangerous. As the stock of greenhouse gases continues to mount, the annual emissions reductions necessary to stabilise at a particular temperature become ever larger and more costly to achieve, while irreplaceable and non-substitutable resources are depleted forever. At the same time, the risk of crossing dangerous system thresholds increases. And delayed action means that society continues to lock in resource-intensive infrastructure and behaviours which are hard or costly to unwind later. Installing renewable technologies that have not been given a chance to mature in a desperate last-minute dash will also raise costs. It is far more cost-effective to manage the transition and work with the investment-depreciation cycle.

General Equilibrium models which assume optimisation by definition (i.e. all agents are rational utility-maximisers; there is no waste) cannot account for these crucial elements. Under these models, any departure from the current equilibrium is scored as a distortion with a cost. Thus they assume that resource-efficient investment is detrimental to growth and deduce that any action is simply a cost. This re-orientates the discussion to ‘affordability’ while making for weak economics. Dynamic public policy analysis is required to understand innovation and learning and the creation of benefits beyond narrow GDP. The expenditure involved in making the transition to a resource-efficient economy must be assessed as an investment and an insurance option, rather than a cost net of benefits.

Innovation will be the driver of green growth

With billions of people in Asia and other developing regions rightly aspiring to the living standards and consumption levels of the rich world, investment in resource efficiency and renewables will be the only way to raise productivity while cutting resource use, waste and inefficiency. Thankfully, output and growth are functions not just of the amount of people, capital and materials thrown into the production process, but also innovation in the processes,

techniques, and technologies with which these inputs are used. This element is termed total factor productivity (TFP). Growth accounting shows clearly that economic growth in most rich countries stems almost entirely from growth in TFP. And knowledge and ideas build on each other; new equipment enables new ideas and better technologies. For example, investing in computers induces bright ideas on how to use them.

This fuels increasing returns to scale in production, where investment in knowledge begets increased output and resources for further investment: a virtuous-growth spiral known as endogenous growth.¹⁰ This means that policy-makers can steer growth by focusing on the factors that drive innovation.¹¹

The impacts of information and communications technology are comparable and probably bigger than those of steam or electricity. There is no previous example of a new technology whose price has fallen so fast, or which has diffused through the economy as rapidly, as innovations in computers and mobile communication. This can vastly increase resource efficiency through better use, monitoring and management.

Some sectors, such as energy, are already witnessing a technology revolution that, after an initial investment phase, is likely to bring down the cost of energy generation based on abundant renewable sources. Many renewable technologies such as solar PV will become competitive with conventional fuels in the next few decades. Some, such as onshore wind, already are. The benefits of learning have already helped costs of solar photovoltaic fall by a factor of five or six in the last five years or so.

This process of induced innovation is a key part of understanding true long-run costs. Improved efficiency will also continue to reduce the amount of energy required to create economic output. Pricing damaging emissions will not only incentivise the development of these technologies, it will also help staunch the so-called 'rebound effect' whereby extra disposable income from efficiency gains is channelled into additional resource-depleting consumption.

Outside the field of energy, some of the resource challenges are more pressing. Unlike conventional energy sources, essential 'elements' (minerals like phosphorus, potassium, arable land, soil, biodiversity, water) are hard to substitute. Until a decade ago, there appeared to be empirical support for the view that commodities were becoming more economically abundant,¹² given the long-term trend of declining commodity, food, mineral and energy prices over the twentieth century.¹³ However, the welcome rise of a growing middle class in populous developing countries has over the past decade clearly reversed century-long price declines across a swathe of commodities, as supply struggles to keep pace with demand.

But there is plenty of scope to use resources more productively. McKinsey highlights fifteen areas where there is great scope for improvement in efficiency, including energy efficiency in the built environment, increasing yields on large-scale farms, reducing food waste, reducing municipal water leakage, increasing transport fuel efficiency, reducing land degradation, improving irrigation techniques, and improving the efficiency of power plants.¹⁴

Investment can need strategic direction

So the path of technological innovation matters. This means that policy must be about more than correcting market failures; government has a significant role in determining the strategic direction of an economy by demonstrating its commitment to a sector. This can give companies the confidence to invest in physical capital, and individuals the confidence to invest in skills development. Moreover, the commercial opportunities are magnified by the fact that the necessary change will be transformative. It will require major investment in all regions of the world and in all economic sectors, including buildings, transport, agriculture, manufacturing and communications. Just as a space race, the military-industrial commitment or the ‘war on cancer’ can induce innovation, so the setting of smart connectivity or green innovation challenges can be expected to create substantial knowledge spillovers, boosting Schumpeterian ‘creative destruction’, innovation and productivity across a broad number of sectors.¹⁵

Economic history tells us that these periods of change are characterised by two types of countries, ‘those where the new industries are being deployed, and those areas of the world that are left out and falling behind’.¹⁶ As Perez notes, ‘Investment concentrates in these core countries, where the whole economy is flourishing and opportunities across the complete industrial spectrum now abound. It is the time of aggressive exports from the core countries.’¹⁷

Like business, governments need to be allowed to take risks

Innovation relies on risk being taken by the public sector too. Much of the innovation funded by the US government after 1945 was a by-product of the space race and the Cold War. The US government played a central role in financing or buying many of the innovations behind the ICT revolution; Silicon Valley venture capitalists took the credit, but they were standing on the shoulders of federal government investment and support over many years. Americans have made huge interventions in markets through vehicles such as DARPA, the US National Science Foundation, the Small Business Innovation Research programme, and the National Institutes of Health.

Companies like Apple, Google, Intel, GSK and Pfizer all benefited from crucial public sector support in developing their key technologies.

What Mazzucato has dubbed the ‘entrepreneurial state’ often takes on the greatest risk long before the private sector dares to enter. In the UK and elsewhere, incentives in the public sector often militate against risk-taking, which relies on a willingness to fail. The competence of policy-makers and public officials is commonly judged on how well they avoid expensive disasters. Indeed, the UK public sector seems to have been particularly conservative by international standards – with some notable exceptions, such as the NHS which, with a clear national mission, supported innovation on pharmaceuticals, helping make this one of the most innovative and successful sectors in the UK. Partly as a result, the UK languishes low in the OECD rankings for research and development spending as a proportion of GDP.¹⁸ As in the private sector, there is a balance to be struck between risk and reward.¹⁹

Most importantly, policy must be credible, transparent and flexible

Intervention needs to be carefully designed in order to avoid replacing market failure with policy failure.²⁰ Expectations play a crucial role in influencing investor behaviour and establishing credibility takes time, so it is critical that policy-makers think carefully about policy design.

In a rapidly changing economic environment, policy-makers must embrace uncertainty on a number of fronts: technology costs, tastes and preferences, resource depletion rates and climate science, to name a few. So policy must be sufficiently stringent to change behaviour, predictable in order to contain policy risk, yet simple and flexible in evolving to changing circumstances while limiting compliance costs.²¹ This requires that it be based on clear rules for review and revision, where the public sector responds to surprises in a predictable manner. Most importantly, stable rules that are not changed retroactively are a necessary condition in order to provide an appropriate return to induce private capital to flow into risky technological sectors. The government must convince businesses that it will not renege on its commitments once investment costs are sunk.²²

Policies should be as neutral as possible, to allow a broad range of technologies to emerge and compete, and to avoid the problem of ‘picking winners’. For example, price signals limit the scope for rent-seeking by avoiding discrimination between technologies and processes, while encouraging competition within sectors. However, governments cannot avoid making choices, given that there are a range of technological options that will be available over the coming decades, with specific barriers and opportunities that may require

targeted assistance.²³ So choices should be well-informed, open and transparent, in collaboration with civil society and the private sector.

The role of environmental policies in setting expectations and providing incentives to induce innovation cannot be underestimated. Even modest and uncertain movement has generated a strong response.²⁴

Policy risk requires public ‘skin in the game’

The private sector is not investing as heavily as it could in green innovation and infrastructure because of a lack of confidence in future returns in this policy-driven sector. Only the government can reduce this policy risk. Thus, by backing its own green policies, the government can stimulate additional net private-sector investment, and make a significant contribution to economic growth and employment.

The government can do this, for instance, by allowing a well-capitalised Green Investment Bank to operate as a lending institution, sharing some of the risk of private investments in green infrastructure. The UK should also work with European Union member states to increase the target for emissions reductions for 2020 to 30 per cent from 20 per cent, supporting the carbon price within the Emissions Trading System. Promoting future growth also requires a shift in the tax base towards materials and resources, and away from intellectual activity. Finally, the Prime Minister and his cabinet colleagues need to be clear advocates for the green economy. If they convey the false impression that we have to make a choice between environmental responsibility and economic growth, they will undermine the confidence of private sector investors in the direction and consistency of future policy, raising the risk premium on such projects. Loose talk costs jobs.

Rapid technical change is always disruptive, but by boosting productivity and resource efficiency, new technologies afford a welcome opportunity to promote sustainable growth. Although harnessing this revolution will be beneficial to society, like most ‘change’, it is not all ‘win-win’ and there will be losers and dislocation. Policy-makers must resist the temptation to respond to lobbying skewed in the interests of existing companies resistant to change as opposed to young companies (or companies that do not yet exist) who threaten to destroy them. Institutions must be designed to resist pressures for protectionism, from vocal ‘merchants of doubt’. Policy must practically manage change, support, re-skill and retool threatened sectors.

But leadership and political will require public support and pressure. Changing social norms takes time – witness the initial response to smoking, seatbelts and drink-driving. But people are ready to act responsibly if they

understand the scale of risks to future generations and have a clear vision of what can be done. Open public discussion and engagement and the building of a common understanding of the challenges is essential for democratic choice and the sustainability of actions. Policies must be explained clearly and made attractive and convenient rather than coercive and complex.

Conclusion

Public policy must be examined in the context of a collection of market failures, and designed to reinforce business confidence and spur innovation. To fail to correct market failures is to distort markets. The most urgent market failure is macroeconomic and is exemplified by the collapse in confidence which has driven an explosion in net saving, pushing real risk-free interest rates to less than zero – truly perverse at a time when physical investment is desperately needed. In the longer term, policy must account for the dynamics of change and learning and the risk of climate change and resource depletion. It needs to be informed by a rich economic analysis of risks, uncertainty, the costs of delay and the impact of technological lock-in and path dependency. Narrow cost-benefit modelling will not suffice.

The setting of green innovation challenges can be expected to create substantial knowledge spillovers, boosting innovation and productivity across a broad number of sectors. But policy that is not credible or clear will raise costs. Indecision risks the double failure of missing an opportunity to lock in to low-carbon resource-efficient infrastructure and unnecessarily extend the economic crisis. The adjustment will be disruptive and it will require bold leadership and substantial early investment. But in the world of innovation, policy choices made today will determine the shape of institutions, technologies and infrastructures that drive our economies for decades. There is no lack of private money, just a perceived lack of opportunity. Credible green innovation policy can reduce uncertainty, restore growth and leave a dynamic and resource-efficient legacy.

Notes

- 1 Source: Bureau of Economic Analysis/Office of National Statistics, quarterly data to second quarter of 2012.
- 2 Ibid.
- 3 Dimitri Zenghelis, 'A strategy for restoring confidence and economic growth through green investment and innovation' (Grantham Institute, 2012).

- 4 Source: United States Treasury.
- 5 Of the seven ‘Magic Growth sectors’ identified in the Twelfth Five-Year Plan, three are low-carbon industries (clean energy, energy efficiency, clean energy vehicles), and the others are high-end manufacturing.
- 6 C. Perez, *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages* (Edward Elgar, 2002).
- 7 Zenghelis, ‘A strategy for restoring confidence and economic growth through green investment and innovation’, Annex table 1 provides a list of pervasive market failures which justify public intervention.
- 8 M. Romani, N. Stern and D. Zenghelis, ‘The basic economics of low-carbon growth in the UK’ (Grantham Research Institute on Climate Change and the Environment, 2011).
- 9 McKinsey, *Resource Revolution: Meeting the world’s energy, materials, food, and water needs* (McKinsey Global Institute, November 2011).
- 10 See Dimitri Zenghelis, ‘The Economics of Network-Powered Growth’ (Cisco, 2011).
- 11 See Dimitri Zenghelis, ‘Networked Solutions for 21st-Century Challenges’ (Cisco, 2011).
- 12 See D. Johnson, ‘Population, Food, and Knowledge’, *American Economic Review* 2000.
- 13 See R. Dobbs, J. Oppenheim and F. Thompson, ‘A new era for commodities’, *McKinsey Quarterly*, November 2011.
- 14 McKinsey, *Resource Revolution*.
- 15 See M. Mazzucato, ‘The entrepreneurial state’ (Demos, 2011); and C. Perez, ‘The double bubble at the turn of the century: technological roots and structural implications’ (*Cambridge Journal of Economics* 33(4), 2009).
- 16 See Perez’s assessment of the next ‘Golden Age’ in *Inside Track* 30 (winter 2012).
- 17 Perez, *Technological Revolutions and Financial Capital*.
- 18 OECD Science, Technology and Industry Scoreboard 2011.
- 19 Institutional reform to enable greater public risk-taking in support of vital innovation may require distancing key institutions from politics. Even in the US, public sector risk-taking takes place strategically at arm’s length from federal and state government – one reason why its significance is so often overlooked.
- 20 Hepburn, ‘Environmental policy, government, and the market’, *Oxford Review of Economic Policy* 2010.
- 21 Dieter Helm, ‘Government failure, rent-seeking, and capture: the design of climate change policy’, *Oxford Review of Economic Policy*, 2010.
- 22 Recent examples of retrospective changes to feed-in tariffs in the UK and Spain provide a case in point.
- 23 Fisher, ‘The role of technology policies in climate mitigation’ (Resources for the Future, 2009).
- 24 See EPO/OECD World Patent Statistics database (PATSTAT), OECD (2010).

Supporting Innovation and Jobs

Dr Patrick Sheehan and Shas Sheehan

The issues of climate change, energy security, urbanisation, and population growth are posing fundamental challenges to today's societies. They will push the world towards a new resource- and energy-efficient economy – and this is essential if we are to meet the needs of emergent industrial nations. Humanity has the ability to meet its present and future needs by implementing sustainable development. However, building a sustainable green future will require large-scale changes across many industries.

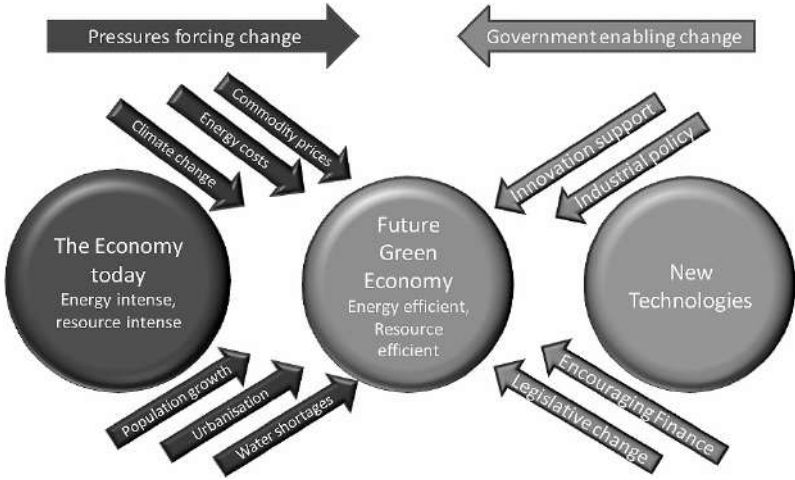
There are of course many obstacles to environmental solutions. Not least, the word 'green' itself has become burdened with negative connotations over the last twenty years. Environmentalism has been seen by some as naïve and impractical. It has been argued that a balance has to be struck between financial and environmental responsibility, that the two are naturally in conflict.

This chapter argues that such an approach is outdated. Today a range of new resource- and energy-efficient technologies (REETs) are being developed which offer the prospect of delivering major environmental benefits and at the same time delivering economic growth. There is a powerful message here: modern green companies can be practical, profitable, and have the potential to greatly improve the economy of a country wise enough to invest in them.

This chapter focuses on REETs and what the UK should do to enable them to prosper. The UK has historically been good at early-stage innovation, at generating ideas and inventions, and in the past decade or so has become far better at starting promising, innovative companies. However, it still struggles to help grow promising companies into viable global champions. We therefore focus here on what government can do to help those companies which have succeeded in commercialising a technology, but are in danger of failing due to lack of capital investment or access to markets.

This is not just about new government initiatives. There is also a strong case for a fundamental overhaul of the way government organises itself so that government departments and industry work together to develop a

Fig. 13.1 Development of the future green economy



sustainable green economy in Britain – amounting to nothing less than an industrial policy.

A brave new world – moving towards a resource- and energy-efficient economy

Whether we like it or not, climate change, looming resource scarcity and other environmental pressures are forcing change. One response has been to suggest that society accepts higher costs and, in effect, a lower standard of living. This is defeatist and at the same time oddly optimistic – you would have to be an optimist to ask the public to vote for an ever-lower standard of living, and a defeatist to deny the power of innovation. The solution lies, as it did at the time of the industrial revolution, in embracing new technologies.

In order to realise the Liberal Democrat ambition of a zero-carbon future for Britain we must of course press ahead with developing the renewable energy sector, but on its own this is not enough. The economy as a whole must also become far less energy-intensive. Energy efficiency technology must be an essential element of national energy strategy. Saving energy is, after all, the most environmentally benign ‘source’ of energy, and has the crucial benefit of reducing costs.

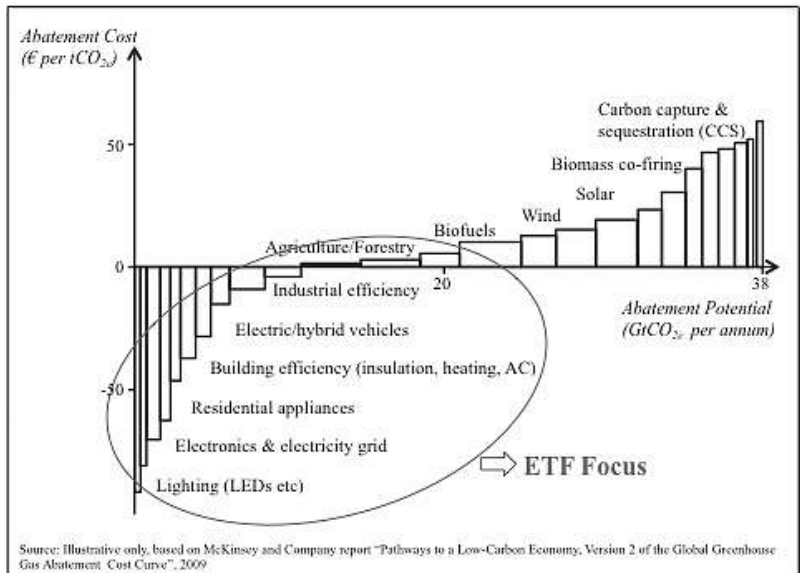
Focusing solely on energy is still too limited, as we need to use all natural resources more efficiently. We need to move to a ‘resource-efficient economy’, not just a ‘low-carbon economy’. It is not just the energy generation industry that will feel the impact. The automotive industry is also on the cusp of

radical change as it experiments with the electrification of transport; the building industry is adapting to new environmental standards, as is the waste industry. Many other industries are also likely to see similar radical changes in the decade ahead – changes that will be driven by resource- and energy-efficiency technologies.

The graph below (Fig. 13.2) provides an illustration of the benefits of REETs.¹ It gives a summary of the contribution made by different technologies, both REETs and renewable energies, to potential greenhouse gas abatement. Each measure is ranked according to whether it saves money or costs money and placed in order from left to right, starting with the most cost-effective (such as switching to LED lighting) and ending with the more expensive measures (such as retrofitting power plants to capture and store carbon emissions). On the horizontal axis, the width of each measure indicates its CO₂ abatement potential. The vertical axis then shows whether a technology will result in cost savings (below the zero line) or higher costs (above the line).²

‘Right-hand side measures’ require investment of large amounts of capital, making a big and necessary impact, but at significant cost. In practice these investments are made by government in the form of subsidies to large infrastructure companies such as the energy companies. The Polluter Pays

Fig. 13.2 Greenhouse gas abatement cost curve³



Principle, although now established, does not motivate the energy companies to invest in technologies that produce more costly energy and which impact adversely on their profitability. Although the potential of these solutions is large, they require heavy long-term government subsidy or higher energy prices. While these approaches, such as carbon capture and storage, are of strategic long-term importance, deployment is not happening quickly.

REETs are quite different. They are defined as those companies that appear in the left-hand side of the curve, typically characterised by the use of cutting-edge technology, with the potential to reduce significantly greenhouse gas emissions and/or use resources more efficiently. They cover a broad spectrum of new technologies that bring costs down because they use resources more efficiently. They can usually be deployed relatively quickly because it is far easier to roll out a new technology that saves money, even in recession. Furthermore, the overall potential of REETs is broadly similar to that of alternative generation technologies. The catch is that it can take time and money to develop them initially, and individually their development is risky. Their commercialisation is typically led by the private sector, often by small entrepreneurial companies. Government is not normally involved, which is one of the reasons why these companies are generally overlooked when evaluating energy policy – even though their cumulative potential impact is very large, and their ‘bang for the buck’ of support from government is huge. Another reason is that quantifying this ‘bang for the buck’ is pretty difficult.

New resource-efficient technologies can be ‘deep green’

Measuring the carbon footprint of a large and mature company is hard enough. Measuring the potential beneficial impact of a new technology that has not yet been widely deployed and is not yet mature is fraught with problems. Nevertheless, the Environmental Technologies Fund (ETF) set out to do this a couple of years ago, working with Trucost, a specialist consultancy.⁴ ETF examined the technologies of ten of its portfolio companies, detailed in the table overleaf (Table 13.1), and their potential impacts.

As a result we think that if the technology developed by just these ten small companies was deployed globally, the environmental benefit would equate to 10 per cent (or 0.5 GtCO₂e) of the EU’s total carbon footprint; i.e. *half of the EU 2020 reduction target*. This is a huge figure. It should of course be treated with caution, as there are inevitable limitations in the methodology⁵ (see below), and in practice not all ten technologies are likely to succeed globally. However those that do will probably be very widely deployed

without any government subsidy. To create the same scale of impact (albeit with greater certainty) by investing in offshore wind, for example, would require investment of a totally different order, around £200 billion.

This list, among other things, illustrates clearly that ‘green’ is not a sector. Innovations creating big environmental impacts are found in many industrial sectors. In essence the underlying message is simple: investing in REETs can produce huge environmental benefits, at relatively low cost compared to the alternatives. The alternatives, such as offshore wind, are absolutely still needed – they are lower risk, and REETs alone cannot get us to zero-carbon – but far more effort should go into supporting innovation.

It must be stressed that more work needs to go into developing robust ways to assess the benefits of new technologies. One of the barriers these young innovative companies face is that they are not immediately recognised as being ‘green’ because there is no industry standard that they can be measured against. Whilst Trucost and ETF have developed one meaningful methodology (the CO₂ impact on an industrial value chain caused by a new technology – hence the globally addressable potential market impact) more work needs to be done and a more standard and universally applicable methodology would be a big step forward.

The UK needs to lead

The UK government cannot afford to stand by and allow other governments to lead the charge in the development of green technologies.

Other countries are spending heavily on the development and deployment of such technologies across a whole range of industries. Their governments understand that the countries that host the new technologies will gain enormously when the rest of the world adopts them, as was the case in the industrial revolution. The only difference now is that global adoption of superior technologies will happen far, far faster. The UK is well positioned to lead in the development of REETs, especially as it holds the advantage of being home to much relevant early-stage innovation. Six of the companies listed above are British, underlining the fact that the UK produces innovative technologies in quantity as well as quality.

As is often said, the UK is good at early-stage innovation, but historically has been far less effective in building businesses based on it. One recent example of this is the development of graphene, a virtually two-dimensional carbon sheet that has revolutionary properties. Discovered at Manchester University less than ten years ago, several other countries acted faster and deployed far greater resources into the commercialisation of graphene than

Table 13.1 Environmental Technology Fund – selected ten portfolio companies

Company name and target sector(s)	New green technology
4energy Telecommunications	Highly efficient cooling solutions suitable for wireless network providers, e.g. Vodafone
Metalysis Metal refining	A breakthrough process for refining high-value metals (such as tantalum and titanium)
Compact Power Motors Electric vehicles	Arguably the most compact and efficient electric power motors in the world
Elstat Smart refrigeration	Energy management devices which enable commercial fridges to adapt according to their usage and environment
Novel Polymer Solutions Polymer manufacture	Polymer coatings which help to bond substances to each other more easily
Nujira Wireless network efficiency	'Envelope tracking' enables power amplifiers, used to generate radio signals, to operate far more efficiently
Perpetuum Industrial process monitoring, rail transport	An appliance that can harvest the energy from small levels of vibration and convert it into electricity
Chemrec Paper and pulp, biofuels	Turns paper-manufacturing waste into biofuels, enabling pulp and paper mills to become secondary bio-refineries
Kebony Hardwoods	Changes the cellular structure of wood, enabling rapidly growing softwoods to become hardwood
Industrial Origami Sheet metal manufacture	Unique technology which allows metal to be folded very accurately, without losing its strength

Environmental impact	Commercial impact
Halving the energy used for cooling in wireless networks	Energy is a significant cost for the rapidly expanding wireless industry, and it is putting significant effort into reducing usage.
Typically, metal refining is a dirty, energy-hungry business. Metalysis uses far less energy and no hazardous chemicals	Significantly reduces refining costs, and also potentially allows materials like titanium to be far more widely used
20 per cent of all the energy generated in the world is consumed by electric motors	Particularly important to the automotive industry as it begins to introduce electric scooters and cars
Can deliver energy savings of up to 60 per cent	Applicable to millions of drink cooling machines, vending machines and industrial fridges worldwide
Facilitates use of modern, environmentally friendly materials	Opens up the possibility of using modern materials in a variety of applications
Nujira's technology reduces energy consumed in wireless network operation by c.40 per cent	The technology has been adapted for use in mobile phones, highlighting its broad potential
Enables the practical use of wireless sensor networks, which then improve efficiency and safety	Enables the practical use of wireless sensor networks for monitoring industrial processes
Turns a large-scale source of waste into a fuel, at the point where the waste is created	The scale of the industry is such that this technology could potentially satisfy 2 per cent of current global fuel demand
Diminishes demand for irreplaceable tropical hardwood. Softwoods are far more sustainable	Softwood, which is relatively cheap and quick to grow, can be converted into more expensive high-quality hard wood
Reduces metal consumption by up to 50 per cent in products such as white goods, greatly reducing the environmental footprint	Sheet metal manufacturing is greatly simplified, dramatically reducing costs and improving productivity

the UK. Whilst UK government did finally respond, late in the day, this example illustrates a real problem which is being made more acute by the ongoing financial crisis.

Smoothing the path of the cleantech revolution

So, what exactly can we do to help these companies at the stage when capital investment is needed?

Firstly, we should acknowledge that action is required on a large scale. We are not talking about small initiatives, or a good bit of PR. The Green Investment Bank is a good first step – but only that – and in practice it is quite focused on renewable energy funding, with only a nod towards energy efficiency and energy from waste. And in any case, the bank's capital is only £3 billion which, even taking into account its leverage potential, is a small fraction of the money required to fund a large scale shift to renewables. It does not really address the broader and more radical theme of a cleantech revolution across many industrial sectors. The Green Investment Bank needs a multiple of its current capital and a significant part of its remit – say, in proportion to the two sides of the graph above – should be the support and promotion of REETs.

Secondly, government can promote investment from other sources – a lower cost option for it. Below we suggest some ways this could be done (from companies, institutions and private individuals). Our suggestions are not comprehensive, and a greater dialogue is needed.

Thirdly, government can also change legislation in industrial sectors directly – the lowest cost option of all. We also discuss this below.

Encouraging investment

Encouraging investment by institutional investors and banks

The UK and European governments have, quite rightly, sought to clamp down on excessive risk-taking by banks. One unintended consequence, however, is to make it harder for banks and other institutions to take the type of risk desired and needed to support younger innovative companies. This problem needs to be addressed. On top of this, much of the legislation we do have, though implemented with good intention, often seems little more than a bureaucratic impediment. Take the example of Silicon Valley Bank, probably the leading global bank specialising in lending to young technology companies. It has had to fight for two years to be allowed a banking licence to do business in the UK. In China the same process took only six months.

We should explore how to create incentives for institutional investors to favour funds investing in innovative young companies, and 'green funds'

over more general funds. Other European countries are looking into this, and the French have had perhaps the most creative and progressive debate. One proposal considered there is for the government to underwrite a proportion of the capital an institution assigns specifically for investment in young innovative companies. This guarantee would be small relative to the total invested, so a call on that guarantee would only occur in the case of very poor performance. The impact, though, could be to direct far larger sums into areas where such guarantees exist.

Encouraging and enabling private investment

Private investor behaviour is already deliberately shaped by government schemes. A savings and investment culture is promoted, for example, via ISAs (such investments are typically made via funds that invest in large, normally multinational, companies). Venture Capital Trusts (VCTs) and Enterprise Investment Schemes (EIS) are, in contrast, used to promote investment in smaller UK companies that many studies show are the engine of innovation and job creation. There are, however, no specific incentives for investing in 'green technologies' or REETs. There is, again, room for a more creative debate in this area; ideas include:

- Enabling individual private investors to invest their capital more easily, and more safely, into smaller UK private companies, the engines of growth. They should be encouraged to spread their risk around many companies, just as a professional investor would do. In other words, it should be made possible for individuals to have VCT/EIS tax breaks when investing in a wider range of collective investment vehicles.
- Specifically, VCT/EIS funds should be allowed to invest as 'funds of funds' into professional venture capital funds that focus on job-creating companies. Such venture capital companies currently only find it practical to raise funds from larger institutions, but could deal with a collective fund of VCT/EIS investors just as it would with any other institution. VCT/EIS rules would have to be relaxed marginally to fit into line with what works commercially for such funds, but this would only require a small amendment to existing legislation. Similarly, ISA collective investment vehicles could be allowed to invest in such 'institutional quality' venture capital funds.
- Create additional 'green ISAs' and 'green VCT/EIS' schemes, in addition to existing ISA and VCT/EIS schemes. Since it is hard to define 'green' effectively, an expert panel could be created that would 'kite-mark' approved funds as having qualifying investment strategies. Consideration would then need to be given to subsequent auditing (though without trying to

encourage bureaucracy). Again, this should include access to traditional venture capital funds that are currently institutionally orientated.

Encouraging investment by companies

The various measures that have been used to encourage investment by individual companies could be applied specifically to encourage green investment. Examples to consider include:

- Enhancing R&D tax credits for 'green' R&D (both in terms of amount and by making such payments more rapid, or even enabling companies to claim 'on account').
- A special programme of capital allowances against tax for 'green' capital expenditure.
- A programme of capital allowances for investment by corporations into green venture capital funds.

Careful legislation can be used to stimulate innovation

In a number of industrial sectors it is also possible to use legislation, rather than subsidy, to promote change. Legislation has the huge advantage, to the government and taxpayer, of being free. National legislation is often viewed by business as a potential obstacle to international competitiveness, but certain types of legislation can aid competitiveness in the medium and longer term – specifically, legislation that acts to promote, or even force, innovation. For example, energy-efficiency legislation for new buildings and anti-pollution legislation in the car industry have each stimulated innovation and international competitiveness.

So, consideration could be given to the more strategic use of legislation of products and markets to promote green innovation. Clearly this should focus on areas where environmental benefits are clear. Equally clearly, care would need to be taken not to be seen to impose short-term costs that are unaffordable or that do not result in significant longer-term competitive advantage. Any legislation should be implemented in such a way as to promote the rise of new industries, particularly industries that can then export their superior technologies to the rest of the world.

Green begins with government

The suggestions we make above are individually worthwhile, but they are only part of the solution.

Decades of industrial malaise on the one hand, and a laissez-faire drift towards a financially dominated economy on the other, have led the UK to a

position where a focused environmental industrial policy is needed. But an overarching industrial policy without a working mechanism to deliver it is useless, and therefore government must change.

The UK needs a system in which the industrial planning and decision-making processes of government are integrated. As stated in the 1987 Brundtland Report, *Our Common Future*, government departments tend to be independent and fragmented, working to relatively narrow mandates with closed decision-making processes.⁶ This is exacerbated by the fact that those responsible for managing energy needs and protecting the environment are institutionally separated from those responsible for managing the economy.

In order for an environmental industrial policy to have a clear focus, this needs to change. Specifically, three government departments must work together closely: the Department for Energy and Climate Change (DECC), the Department for Business, Innovation and Skills (BIS) and the Treasury.

DECC combines energy and climate change into one governmental organisation, inevitably then seeing climate change as one of a number of energy problems. Within this remit it does have a clear focus and appears to be doing a good job, and we would not want its efforts reduced. However, climate change is not a sub-sector of energy, so should not be represented solely within and by DECC.

BIS should have at least as great an interest in what we see as an industrial revolution. While it theoretically has an important role in shaping future government policy regarding green issues, it appears relatively unfocused and ineffectual. BIS should not be restructured in a manner which would amount to merely a cosmetic exercise of 'rearranging deckchairs'. Nor should it simply be abolished. BIS has a vital role to play, but needs a genuine and radical overhaul, with the clear purpose of creatively and assertively implementing a long-term programme to create a green economy which promotes growth and jobs. If BIS is to lead a green revolution it must be revolutionised.

It goes without saying that without the close cooperation of the Treasury, change will be impossible. To get these three arms of government to work together constructively will require strong leadership; responsibility for this agenda must rest with a high-profile individual from the highest echelons of government. This should be a specific appointment.

Conclusion

Green is not a single sector, it is an 'impact' that is found across all sectors

Attempting to deal with green issues as if independent from the rest of life is the wrong way to address the issues, and creates a disconnect between

environmentalism and economic realities. All industries can benefit from increased resource and energy efficiency.

Resource- and energy-efficient technologies are a vital part of the green solution

These companies can deliver both green and economic benefits. They enable 'green growth' and job creation.

Growth should be enabled by emphasising investment in green technology

Both large institutions and private investors have a role to play in supporting resource- and energy-efficient technologies (REETs), and this role should be encouraged by incentivising investments that are deemed 'green'. Government should also use legislation to enable green growth.

The UK should take a bold lead

Without a focus on developing technological innovation, the UK will fall behind other countries. Britain will be far better off as a country in the vanguard of a technological revolution, rather than subsequently importing the results of one that has happened elsewhere.

The UK government must refocus itself

The UK government's approach to such green issues is too departmentalised, fractured and lacks direction. As a minimum, inter-departmental communication and cooperation regarding this should be increased, and the Department for Business, Innovation and Skills in particular needs to place this issue far higher up its agenda. If BIS is to lead a green revolution it needs to be revolutionised.

Notes

- 1 The graph is not intended to be definitive, both because costs, particularly of new technologies, tend to change over time and because it only shows examples of some technologies (for example this version omits tidal and wave, as well as nuclear, power).
- 2 CO₂ abatement is measured in billions of metric tonnes of CO₂ equivalent per year (GtCO₂e per annum). The cumulative potential of each of these measures if pursued to their full potential would be 38 GtCO₂e per year. As a reference point, global greenhouse gas emissions may increase to around 56 GtCO₂e in

2020 according to business-as-usual projections (United Nations Environment Programme).

- 3 Source: Environmental Technologies Fund illustration, based on McKinsey & Co., *Pathways to a Low-Carbon Economy: Version 2 of the Global Greenhouse Gas Cost Abatement Curve* (2009).
- 4 One of the authors, Patrick Sheehan, is a founding partner of the Environmental Technologies Fund.
- 5 It must be stressed that more work needs to go into developing robust ways to assess the benefits of new technologies. One of the barriers these young innovative companies face is that they are not immediately recognised as being ‘green’ because there is no industry standard that they can be measured against. Whilst Trucost and ETF have developed one meaningful methodology (the CO₂ impact on an industrial value chain caused by a new technology – hence the globally addressable potential market impact), more work needs to be done and a more standard and universally applicable methodology would be a big step forward.
- 6 World Commission on Environment and Development, *Our Common Future* (Oxford University Press, 1987).

Green and Growing: The Importance of Cleantech

Julian Huppert MP¹

With a mountain of debt and low growth weighing heavily on our country, this decade could well become a lost opportunity for environmental policy. Liberal Democrats continue to call for proper action over climate change, but the temptation to dilute our commitment has increased as ‘green government’ has been portrayed as an unaffordable barrier to growth.

Lib Dems must reclaim environmental protection as a clear and necessary policy which benefits British society now and in the future. But we must also make the case for green growth – for an industrial policy which incubates economic growth by supporting climate change mitigation. We need an unambiguous vision of what green growth looks like: one we can put to the public in 2015, and one we can build on beyond the next election.

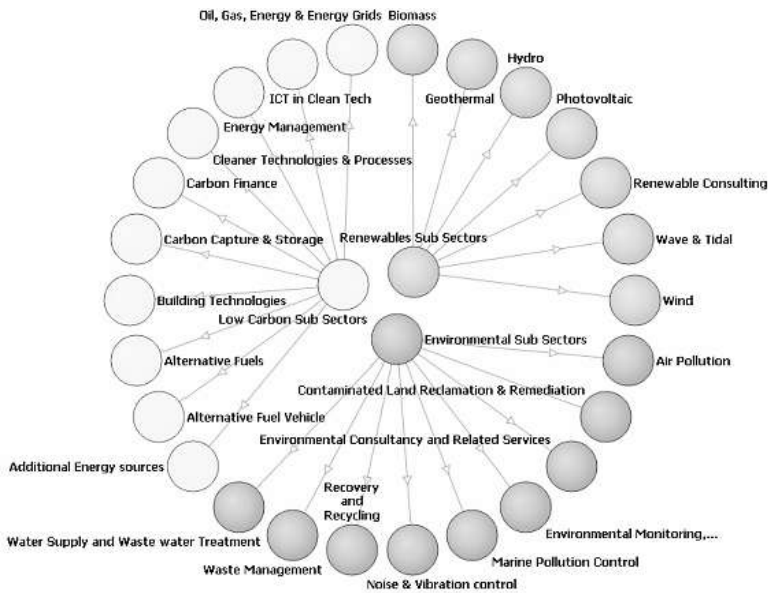
The UK clean technology sector (here referred to as ‘cleantech’) is already one of the key drivers for job creation and growth. The myriad of emerging cleantech companies, such as those clustered around Cambridge, point the way to green growth, and should provide a guiding light for liberal policy-making. Cleantech is a trillion-pound global industry, in which the UK has already excelled. It has the potential to create wealth and jobs, and help combat climate change. We must support it as a central plank of our green growth policy.

However, as will be discussed, there are also many obstacles standing in the way of a flourishing cleantech industry in this country. Decisive leadership and coordinated policies are needed to enable the UK to overcome these barriers and become a world leader in the field.

The cleantech industry

Cleantech is any new technology that helps to reduce our carbon footprint and use energy sustainably; it covers both sources of renewable energy and ways of using energy more efficiently.²

Fig. 14.1 Definition of Cleantech



The global cleantech market already has a market value of £4.3 trillion and is forecast to grow 5 per cent each year for the next five years. The rising price of fossil fuels has played a key part in this.³ Public attitudes are also shifting; consumers are increasingly demanding products which are environmentally friendly. Finally, governments are competing to put their country on the cleantech map and create jobs.⁴

Many British companies are already profiting from the shift towards sustainable technologies. The UK has been reasonably successful in carving out a place for itself in this emerging industry, and constitutes 3-4 per cent of the global cleantech industry. According to the 2012 Global Cleantech Innovation Index, the UK ranks tenth in the world for providing the best conditions for cleantech start-up creation.⁵ Cambridge, in particular, has a thriving cleantech sector and is home to many leading businesses in the industry, such as AlertMe, Breathing Buildings, Eight19, Cambridge Carbon Capture, PolySolar and CamSemi.

Despite this strong potential, however, there are several challenges facing the development of the cleantech industry. The research and development (R&D) of new technology, the growth of new companies into national businesses, strong national demand and access to foreign markets are all

critical for green growth. The UK is in danger of falling behind other countries if we do not overcome these barriers – we may be in the top ten in the cleantech index but we are fifth in Europe, and the market leaders have the most to gain.

So how can public policy contribute to a budding cleantech sector in strained financial times? What should we, as Liberal Democrats, be pushing for at government level?

The early stages – research and development

As a young sector dependent on cutting-edge scientific development, the cleantech sector is dominated by small emerging companies, some of which will grow into international giants, many of which will fall at the first hurdle. Few of these companies have enough resources to invest significantly in R&D. But there are benefits from having a multiplicity of small- to medium-sized enterprises. In particular, if we can ensure that small companies with bright ideas can be supported at the earliest stages, we can foster exactly the kind of creative thinking – with its concomitant successes and failures – which is critical to cutting-edge technological development.

Finance

Financial obstacles are particularly significant in this young industry. Research is capital-intensive; new cleantech companies need to secure a large amount of capital in order to carry out their projects. At the same time, financiers can be asked to wait a long time for a return on their investment, which can be a deterrent.

A recent report from Taylor Wessing, the Cleantech Group and Real Deals found that both venture capital and private equity investors are turning to firms with innovations which are reaching the end of the R&D phase. A 2010 report by the Greater Cambridge Partnership found that just 3 per cent of cleantech companies in the Cambridge cluster had received venture capital; comparable sectors such as ICT were 40 per cent and healthcare and biotechnologies 36 per cent.⁶ A 2011 survey of 312 UK cleantech companies showed that 29 per cent of companies interviewed ‘cited a lack of access to finance as the main obstacle to expansion’⁷

As a consequence, many cleantech businesses rely on subsidies and grants, from the UK Government or from the EU. The Taylor Wessing report highlighted that corporate investors and public funds are therefore providing a disproportionate level of funding, which punishes riskier early-stage R&D in younger companies. Uncertainty over the future of this

assistance, particularly during a period of economic austerity, has created additional risk.⁸

The lack of public funding for R&D to fill this gap, when considered against the situation in comparable economies, is particularly worrying. A recovery in green investment has been seen since 2010, with a 35 per cent increase in investment in the clean energy sector in 2011. But the UK's investment is failing to grow as fast as some of its rivals. In terms of investment growth over the last year, the UK comes sixth behind Indonesia, India, the US, Italy and France. A report from the Pew Environment Group in 2011 also showed that the UK has failed to make the top ten in investment growth over the last five years.⁹

The Coalition Government is establishing the Green Investment Bank to fund green projects in the UK – a crucial Lib Dem success. Funding of £1 billion for the bank was announced in the 2010 Spending Review and a further £2 billion in the 2011 Budget. The ambition is to grow the Green Investment Bank over time. With the Government in extraordinarily tight fiscal circumstances, the priority for Liberal Democrats now should be to enable this bank to borrow in order to lend, and this must be underwritten by the Government.

This policy is, however, by no means a silver bullet. The UK's credit rating is predicated on the security of the public finances, which may not be helped by underwriting investment in green industries. But as the Stern Review so clearly showed, the cost of doing nothing on climate change outweighs the costs of acting now. While the UK government would be underwriting a wide portfolio of green industries – some of which will succeed and some will not – the sector is forecast to grow every year in spite of the recession.¹⁰ For that reason, it should be able to borrow to lend, and restrictions on venture capital funding should be lifted.

In addition, the scale of investment in comparable economies, and the underlying cost of greening our economy in order to meet our carbon targets, necessitates either an extremely large level of investment or an industrial policy which underwrites and underpins new investment. Estimates of the costs of meeting UK carbon targets range from £200 billion to £1 trillion. We can either act now to develop the technology to help mitigate those costs, or we can delay our actions, damage our environment and spend vast sums buying new technologies later from countries which did invest in cleantech.¹¹

Clusters, deregulation and government policy

Having said that, the Government cannot just underwrite the entire sector without initiating significant structural reforms and providing consistent support for the clusters which do exist.

The first priority should be to leverage private-sector investment.¹² Of course, loans from the GIB will signal confidence in the sector and in cleantech companies; there is no better way of showing venture capitalists and private equity firms that cleantech is a safe bet than a loan from the independent GIB underwritten by the Government. But the cleantech sector must become an attractive hub for entrepreneurial investors in its own right.

In order to achieve this, the Government should also target existing funding streams to entrench cleantech ‘incubators’. The Cambridge area benefits from several business ‘incubators’ which help cleantech companies get off the ground. For example, Cambridge Cleantech¹³ offers clients access to finance, advice from experts in the field, opportunities to promote their business internationally and advice on government regulations. Other groups such as the Technology Partnership offer similar services. The Government’s priority should be to direct existing funding streams towards these clusters.

In addition, tax credits are an effective way of supporting companies willing to risk their own capital in R&D. Since coming into office, the Coalition has increased the rate of relief available for small and medium-sized enterprise (SMEs). The system could be further targeted towards high-tech environmental companies by offering a higher rate for environmentally beneficial schemes. According to the OECD, in 2011 the UK ranked nineteenth in terms of the attractiveness of its tax system incentives for R&D.⁴

Support for cleantech clusters

To maximise the potential benefit to the economy of the cleantech sector in the current climate of limited public funding, existing economic development budgets should be partly refocused to support the sector. This could include:

- Targeted cleantech sector programmes initiated by the Technology Strategy Board.
- The cleantech sector prioritised in the allocation criteria for the Regional Growth Fund.
- Government loan funding for SMEs via the clearing banks to include cleantech as a priority sector.

To help boost growth in the economy, a more radical solution would be to focus Department for Business funding on the cleantech sector as one of a small number of high-priority growth sectors.

Martin Garratt, Chief Executive, Cambridge Cleantech

Consistent policy-making

From feed-in tariffs to zero-carbon new build home requirements by 2016 and to domestic smart metering requirements by 2019, the cleantech sector is driven by government regulations and incentives. More clearly defined and consistent regulation was the second highest concern in the survey of cleantech companies conducted in 2011. (Cleantech Group and The Carbon Trust, ‘Bullish UK cleantech entrepreneurs confident of green growth’).

Whilst no cleantech company business plan will be totally reliant on government regulation, there is a reasonable expectation that it should be clear to understand and be consistent over time. The recent debacle over reducing feed-in tariffs for solar PV at very short notice is a case in point of how not to regulate and incentivise the sector. Such ‘moving of the goalposts’ makes for very difficult business planning. Government should instead set out a clear plan, which may involve reducing tariffs over several years, but which would be clear and consistent and not subject to short-term changes.

Martin Garratt, Chief Executive, Cambridge Cleantech

Finally, the government should take extreme care, that, whatever funding streams, tax incentives or policy initiatives it implements, the application is consistent and the deadlines are clear.

Universities and immigration – fostering ideas and attracting talent

The cleantech sector is heavily dependent on a very close interaction between businesses and universities, while the success of budding companies is dependent on the talents of the people who run them. The co-location of the Cambridge cluster and the University is critical to its recent success.

It is crucial, therefore, that in the next budget the Government ring-fences – and increases – the existing science research budget. This was a particular success in the Comprehensive Spending Review; the Government agreed to freeze the £4.6 billion revenue science budget for the rest of the Parliament. But the slower than expected pace of deficit reduction may result in further spending cuts. This must not fall on the science budget, which is a key driver of growth, ideas and, ultimately, tax receipts.¹⁵

Talent is also vital for success in the cleantech industry. For that reason, the Government must change course on immigration policy. Current Home Office policy is to reduce immigration to the tens of thousands. To achieve

that, almost all non-EU economic migrants are now effectively treated as ‘guest workers’, and economic migrants coming from outside the EU to fill skills shortages are to be expected to stay no longer than five years, with the exception of those who earn more than £150,000 per year or who work in the sports sector.

This provides a clear disincentive for scientists and industry leaders to come and live and work here. Nearly half of all UK researchers collaborate with overseas colleagues, while a number of foreign scientists have won Nobel prizes while working in British labs. A recent report by the Breakthrough Institute set out a clear path for the US to grow their own cleantech industry by removing barriers to immigration for foreign scientists and engineers who wish to work in the US. The UK must provide similar exceptions for talented scientists, and we must do so as soon as possible.¹⁶

The co-terminosity of finance, ideas and people is absolutely critical. This three-pronged strategy will help get cleantech off the ground in the UK. Increased government support, policies designed to leverage more private sector investment and tax breaks for start-ups are all necessary. But it is not just this initial phase where there are problems to overcome.

Scaling-up – creating demand at the earliest stages

Following the development of a new product, there are challenges involved in scaling up a business from serving a niche market to a national one. This stage has been found to be a particular stumbling block for British cleantech businesses. According to the 2012 Global Cleantech Innovation Index, Britain does well at encouraging innovation but poorly at commercialising this innovation:

Evidence of commercialised cleantech innovation measures the ability of a country to scale up innovations developed by cleantech start-ups. The increasingly global nature of the cleantech industry means that this is not necessarily a measure of where those innovations originated; however, a domestic market does help drive innovation and provide a test-bed where products and companies can develop before efforts begin to build an international customer base ... The UK performed less well on commercialised cleantech innovation due to low renewable energy consumption and cleantech company revenues.¹⁷

This implies that although innovation exists and companies are being created, we are failing to scale up effectively due to low demand for cleantech products, relative to other countries.

Successes so far

Liberal Democrats in government have created a solid base from which domestic demand will emerge – our first priority should be to highlight the successes of these policies and argue for their retention.

The Green Deal is encouraging energy efficiency improvements in homes, paid for by savings from energy bills. This has already created demand for clean technology, such as solid wall insulation. Steps have also been taken to increase the UK's capacity for microgeneration through the use of feed-in tariffs, which has provided significant demand for cleantech companies, while the Electricity Market Reform Bill will give greater certainty to developers of renewable electricity technologies. Finally, the Renewable Heat Incentive is further stoking demand for climate mitigation tools.

Already this has borne fruit. Cambridge Retrofit, a scheme aimed to make Cambridge the first city to meet the 2050 carbon reduction target, has enabled private and public sector organisations to team up to create a city-wide carbon reduction scheme. This, in turn, has provided a large market for local cleantech companies to provide sustainable services and technologies, which will ultimately allow these companies to grow and export.¹⁸

Public procurement and green growth

The Liberal Democrats should look to further demand-side reforms to supplement this growth. Government procurement contracts can provide companies, particularly new start-ups, with a powerful incentive to develop new technologies. However the UK's track record of using procurement to stimulate innovation is poor compared to countries with thriving high-tech sectors like the United States or Finland.¹⁹

The Government has made clear its aspiration that 25 per cent of government contracts should be awarded to SMEs, compared to just 12 per cent currently.²⁰ This has the potential to benefit new cleantech companies because the sector is dominated by smaller enterprises. But the Government should do more to specifically target cleantech.

Two areas where demand could drive the cleantech sector, through a combination of procurement and changes to existing regulations, are transport and housing.

Iarla Kilbane-Dawe, Liberal Democrat candidate for Edmonton in 2010, recently worked on a procurement strategy for electric vehicles (EVs). His work showed how the Government could use sustainability criteria to create a preference in government service procurement for competitive bidders

who use EVs. For example, reform of the conditions attached to the Bus Service Operating Grant could supplement the Green Bus Fund by incentivising procurement of low-emissions buses.

In addition, the Government should further consider high-visibility pilot schemes to generate confidence in UK electric vehicle production and identify gaps in knowledge. One example is the Big Switch, advocated by former Liberal Democrat London Assembly Member Mike Tuffrey, which would require London buses, taxis and vans to convert to electric power by 2020. While the scheme seems ambitious, Tuffrey showed how the entire scheme could be cash-positive by 2023 due to the rising price of fuel and the falling cost of battery technology. Sainsbury's are already considering changing all their urban deliveries to electric vehicles for cost reasons.²¹

Sustainable building technologies are also an integral area of the UK cleantech industry, and one which we must incentivise. A proper housing policy is one way in which we can both promote this sector and solve the country's housing crisis. One way of doing so could be a combination of continued low interest rates and planning reforms to incentivise building; Tim Leunig, former Chief Economist at CentreForum, identified the benefits of such a policy for our housing crisis, our unemployment and our lack of growth.²²

If this policy was combined with tough new criteria in the National Planning Policy Framework about the sustainability of the construction process and the final buildings, rather than their location, we could use this solution to address the UK's housing crisis and spur the cleantech industry. Together these policies have the potential to create truly green growth in the UK.

Making carbon pay

Support for particular sectors, such as transport and housing, must be coupled with proper carbon pricing. It is important that the cleantech industry is free to think holistically about how carbon can be reduced in every single sector.

Following the Climate Change Act 2008, the UK now has binding carbon budgets which ensure that where emissions rise in one sector, corresponding falls will need to be achieved in another. The Act also established unilateral legally binding greenhouse gas emissions reduction targets of at least 34 per cent by 2020 (from 1990) and at least 80 per cent by 2050. Further, the Electricity Market Reform Bill and the carbon price floor for the electricity generation industry, which will be introduced from April 2013, will help to promote renewable electricity production.

While these policies provide a framework for action, and set out our overall targets, it is critical that investors are provided with a guarantee that, in whatever industry they choose to invest, the price of carbon will ultimately rise, and there will be a market for low-carbon alternatives. For that to happen, Liberal Democrats should look to create a proper carbon price with a trading scheme in the medium to long term.

We must pay close attention to how the scheme works in Australia. They have already introduced a price of A\$23 per tonne for carbon, with substantial compensation for consumers and companies exposed to foreign trade. The price is due to rise each year until 2015, when it will be set by the market.

Under the European scheme, the price is set by the number of carbon credits available. To date, the market has been flooded, keeping the price below the necessary level to meet carbon reduction targets, creating an uncertain climate for investors. The carbon price floor being introduced by the Chancellor from April 2013 in an attempt to meet this problem is an unsatisfactory solution – since it is being introduced unilaterally in the UK, an unintended consequence will be a surplus of allowances becoming available from UK enterprises, thus driving the price down in the EU even further. There is no substitute for reducing the total number of allowances available at an EU level, which means arguing for a more ambitious EU emissions target – creating a clear market incentive to switch to renewable technologies.

Finally, a border tax on carbon-heavy imports could also reflect the damage caused by cheap, unsustainable production methods in some countries from which the UK imports. Similar ideas have been proposed in the US and in the EU. Although no agreement has been reached in the European Commission, the UK could support a limited measure requiring industries to buy some credits in the Emission Trading Scheme if their country has no carbon abatement programme.

Export-led recovery

UK green growth policies should focus on R&D, scaling up and boosting domestic demand. But we must capitalise on domestic developments as soon as possible if we are to grow our cleantech companies, grow our economy and become world leaders in sustainable technologies. That requires substantial support for cleantech exports.

UK Export Finance, the operating name of the Export Credits Guarantee Department (ECGD), is the UK's export credit agency under the auspices of the Department of Business, Innovation and Skills. Its role is to support UK companies to export, by providing guarantees, insurance and reinsurance

against loss. However, reform of the agency is urgently needed to provide the best service for UK business and cleantech in particular.

Virtually all the ECGD's support goes to a handful of large companies. The ECGD has great potential to support and promote new, green industries, but at present it supports proportionally more carbon-intensive industries than any other EU country. In 2009–10 90 per cent of ECGD's portfolio concentrated on the commercial airline industry. Worse than that, its non-aerospace activities declined by nearly 90 per cent, while over the last decade overall business declined by 70 per cent.

The Coalition has said that ECGD and UK Trade and Investment (UKTI) will not support 'dirty fossil-fuel energy production', but this commitment has yet to be implemented. We must go further, by changing the statutory footing of UK Export Finance to make it more accountable and more open, and also to include a presumption in favour of sustainable technologies when it is considering which exports to support. £50 million a year was ring-fenced in 2003 for supporting renewable energy, but this money was never spent.²³ The whole ethos and purpose of the organisation must change if we are to support the greener industries which are destined for long-term growth rather than short-term gain.²⁴

In addition to financial support from the ECGD, British companies can receive export advice and assistance from UKTI. UKTI already organises promotional activities to reach SMEs and cleantech organisations, as well as assisting in press and marketing. But the focus must be on cleantech. Again, greater accountability and a statutory focus on sustainable technologies would provide UKTI with the tools and direction it needs to support green growth.²⁵

Conclusions

The expansion of the cleantech sector in the UK is something Liberal Democrats naturally support. As fossil fuel prices continue to rise, renewable energy and energy-saving technologies will grow. Countries that invest now will reap the rewards in the years to come.

As Liberal Democrats, we have already played a key role in reforming barriers to success for fledgling cleantech companies. Increasing investment through the Green Investment Bank, making funds available so that banks can lend with confidence, and ring-fencing science research funding are all coalition policies of which the Lib Dems can be proud.

But over the coming years we need to make the case that the less the country invests in the cleantech sector, the more it will cost us in the future. We

can do this by promoting existing cleantech clusters, such as in Cambridge, but we also have to ensure that there is a growing domestic market for carbon reduction technologies – a market which our companies can thrive in, before exporting across the globe.

I strongly believe that the liberal choice is to make carbon pay, and allow our scientists and small companies to innovate and grow. It is hard to imagine that, by 2050, the choice will be between green or growth. The sooner we encourage British cleantech companies to emerge and grow, the faster we will capitalise on the greening of the global economy. There is a palpable lack of a clear industrial policy to place our country on a sustainable footing. I firmly believe that liberals everywhere should look to the thriving cleantech sector as a crucible for action over the coming decade.

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Revitalising the Green Investment Bank

Christopher J. Wigley

Other chapters have highlighted the environmental challenges the UK is facing. Alongside these we have the challenge of designing and implementing an innovative energy policy, providing both energy security and a transition to a low-carbon economy, and of seeking hundreds of billions of pounds of investments to fund this critical transition.

We also face financial challenges. As the government observes in its National Infrastructure Plan, the next decade in finance will be different to the last decade: 'ongoing instability in financial markets could disrupt the supply of long-term bank lending for project finance'.¹ Additionally, 'the principal sources of private finance for the UK's existing infrastructure pipeline – the balance sheets of utility companies and commercial banks – may be facing growing pressures in the medium to long term'.² Indeed, due to changes in the regulatory environment such as Basel III,³ banks may not be able to dominate the financing landscape in the same way as before. Similarly, Solvency II may change the asset mix for insurance companies.⁴ Recognising this, the UK government has adopted the strategy of bringing in institutional investors such as UK pension funds to provide finance. This is logical: following the financial and economic crisis the government cannot afford to fund long-term projects as it did before, while pension funds do need to find long-term assets to match their long-term liabilities.

There is also a need to mobilise finance at scale from institutional investors. The UK Green Investment Bank (GIB) is intended to accelerate investment in green technologies and infrastructure. By providing a focal point for green finance, the GIB can help to attract and facilitate private-sector investment flows to green projects. Its positive attributes include critical mass and a government mandate. It possesses a critical role and must be innovative and creative to meet the challenge of the transition to a lower carbon economy, with the accompanying rewards of green growth and jobs.

The Green Investment Bank: history and outlook

The adoption of the Climate Change Act 2008 stimulated debate on ideas for the transition to a low-carbon economy. In March 2009, Climate Change Capital and E3G recommended the creation of a Green Investment Bank to catalyse private-sector investment, while in September of the same year, Policy Exchange called for the establishment of an Infrastructure Bank mandated by national priorities.⁵ In 2010, all three main political parties included in their general election manifestos pledged to establish either a Green Investment Bank or an Infrastructure Bank. After the election, in June 2010 the 'Green Investment Bank Commission' – established by the Conservative Party while in opposition – recommended the creation of a Green Investment Bank within a year. In October the government announced plans for its creation.

In October 2012 the European Commission granted state-aid approval for the Bank; it has already started to operate as a grant-making fund as UK Green Investments. In November 2012 it was formally launched by the Secretary of State, Vince Cable. While it is a relief that the GIB is now up and running, there are concerns that its operations may not be optimal or resourced adequately to meet the challenge.

The GIB is commencing operations with just £3 billion of capital to 2015–16 – which seems unambitious given the scale of the challenges. An Ernst & Young report estimated that the UK funding gap for low-carbon technologies alone to 2025 is £330 billion – £360 billion.⁶ In light of this, it is also a concern to hear GIB's comments on its strategy – which include being cautious and seeing profitability as an important objective.⁷

GIB has made some positive first steps but could do more. In April 2012 the GIB team started investment, with up to £180 million for specialist fund managers to co-invest equity into waste and non-domestic energy efficiency infrastructure projects.⁸ Although in December 2012 the GIB additionally lent £45m for an offshore wind facility, the particular focus on equity investment is not promising.⁹

A recent interview in the *Financial Times* with the GIB's Chief Executive illuminates the issue. Shaun Kingsbury was reported as saying, 'I'm not a green activist. I'm an investor ... it's really important for me to do the thing I know how to do best, which is to make money'.¹⁰ Of course, wealth creation is to be encouraged, but profit targets or an overly cautious approach should not be allowed to become obstacles to the transition to a low-carbon economy. GIB should not be loss-making but a not-for-profit organisation seems to be more appropriate.

The prime environmental objective must be the raising of hundreds of billions of pounds for green investment. It seems inconceivable that a fund structure similar to Investors in Industry (3i), for example, could provide finance on the scale necessary. While GIB is now indeed a bank, not just a fund, it is significant to see how many of its senior personnel are from 3i,¹¹ the fund specialist. 3i has been criticised in the City. They threw themselves into the paradigm of a new economy in the late 1990s and their funds disappointed investors as the tech bubble burst. An additional concern is that equity finance provided with co-investors may not necessarily deliver the desired levels of transparency expected.

Further, much of the senior expertise at GIB appears to be in 3i's specialist field, that of private and listed equity.¹² As at December 2012, there does not seem to be any senior member executive with specialist experience in bond finance. This is a serious concern, as bond finance is lower cost than equity, both to the government and to potential green corporate borrowers.

The Green Investment Bank: potential

As mentioned above, the government has tried to attract private finance for infrastructure from the pension funds. However, they are targeting just £20 billion – tiny in the context of what is needed. And the pension funds are proving reluctant to invest even this amount due to the government's unconvincing commitment to policy stability.

There is, however, tremendous potential for investment through bond finance. Global bond markets currently amount to US\$99 trillion,¹³ twice the size of global equity markets (US\$49 trillion).¹⁴ Bonds are a frequent and important funding vehicle used by governments and companies across the world, from the US Treasury to Toyota to Network Rail. They are a core asset class for all institutional investors, accounting for about 43 per cent of assets for pension funds, more than equities.¹⁵ With bond markets being so large, the largest investors in the world continually need to reinvest in new bonds as their existing bonds reach maturity.

Global institutional investors cover a massive universe. In the UK, the largest pension funds include BT Pension Scheme (US\$58.0 billion), Universities Superannuation Scheme (US\$50.3 billion), Electricity Supply Pension (US\$39.9 billion), Royal Bank of Scotland Pension Fund (US\$35.6 billion) and Railpen (US\$27.8 billion).¹⁶ Other large UK institutional investors include insurance companies such as Prudential, Aviva and Standard Life. Large global pension funds which have an interest in investing in infrastructure around the globe include California Public Employees Retirement

System (US\$214.4 billion), California State Teachers Retirement System (US\$138.9 billion), Ontario Teachers' Pension Plan (US\$108.1 billion) and Australian Super (US\$37.8 billion).¹⁷

However, possibly the largest investors in the world are the sovereign wealth funds who have hundreds of billions of dollars invested. These include the Government Pension Fund of Norway (US\$611.0 billion), the Abu Dhabi Investment Authority (US\$627 billion), the Chinese SAFE Investment Company (US\$567.9 billion), Saudi Arabia's SAMA Foreign Holdings (US\$532.8 billion) and Government of Singapore Investment Corporation (US\$247.5 billion).¹⁸

Bonds are a natural investment vehicle. Institutional investors, particularly pension funds, often look for long-term assets to match their long-term liabilities. Long-term infrastructure assets are therefore ideal. For responsible investors, green infrastructure is even better. For a facilitator such as the Green Investment Bank, this is a good time to seek finance – as it is for any borrower who is not overly indebted. Due to the economic crisis, the Bank of England's base rate is at the lowest level for more than 300 years. Similarly, due to the Bank's programme of quantitative easing, long-term interest rates are also at historically low levels of between 2 per cent and 4 per cent.¹⁹

Agency Banks and the asset-backed security model

Government agency banks have existed for about 150 years. Credit Agricole was established in 1860 with a primary remit to supply credit to the French agricultural industry. In 1958, the European Investment Bank (EIB) was established to facilitate the integration, balanced development and economic and social cohesion of EU member states. EIB raises substantial funds on the capital markets which it then uses to provide loans and other financial products to projects furthering EU policy objectives.

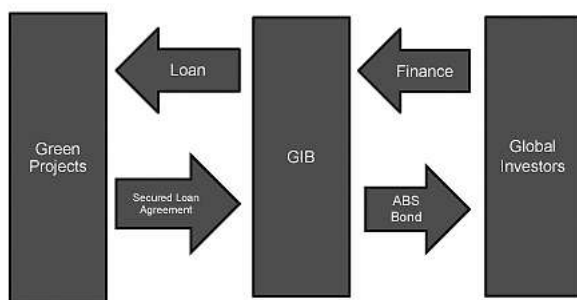
Possibly the most commonly cited example is Kreditanstalt für Wiederaufbau (KfW), the agency bank set up by the Marshall Plan in 1948 for the reconstruction of Germany. It is 80 per cent owned by the German government and 20 per cent by the Länder. Significantly, it has a large presence in residential energy efficiency, renewable energy and municipal public transport and sanitation. KfW is able to provide lower than normal interest rates. The German government guarantees by law all existing and future obligations in relation to funds borrowed, bonds issued, obligations guaranteed and derivative transactions entered into by KfW. It borrows approximately €80 billion a year from the capital markets but its debt is not consolidated into that of the government.

While it is not recommended that GIB's direct debt is similarly unconsolidated with that of the UK government's, it is not a huge leap to explore the possibility that the agency status of the GIB may also bring benefits to infrastructure and a green economy in the UK. Significantly, there is a way in which the GIB may borrow from capital markets, lend to the green economy and yet not increase liabilities for the UK government.

The GIB could, using funds already available, make high-quality secured loans to the green sector.²⁰ It can then use these loans as collateral to back global bonds. In this way, acting as an intermediary, GIB could access more finance, not from the government but from the global investment community such as pension funds, insurance companies and sovereign wealth funds.

The GIB could use its loans to issue global bonds on a secured basis through, for example, an asset-backed security (ABS) or covered bond, which should receive high ratings from the credit agencies due to the high quality of the collateral and bond structure. Once such bonds had been issued and the funds received, GIB's balance sheet is freed up to make additional loans to the green sector, and so the cycle may continue. It is not continually drawing on the government's capital; it is, rather, efficiently recycling it.

Fig. 15.1 The model



There is currently high demand from UK and global pension funds, insurance companies and sovereign wealth funds for such highly rated, long-term infrastructure bonds. The GIB should, over time, foster expertise to develop other specific financial instruments focused on the green sector, to provide additional finance by appealing to additional long-term investors.

The investment priorities for the GIB for the period to 2015–16 include support for the Green Deal and non-domestic energy efficiency, commercial and industrial waste processing and recycling, and offshore wind power.

All would benefit from this innovative and low-cost financing. However, the restrictions on borrowing placed on the GIB by the Treasury – which is that it will not be able to borrow before 2014–15, and then only if public sector debt is falling as a percentage of GDP – are a serious constraint. In fact current Office of Budget Responsibility projections indicate that public sector debt will not be falling by then, so the ability of the GIB to borrow in its own name or on an unsecured basis from the financial markets will be delayed.

An Agency/ABS model may, however, provide a solution. Borrowing through an ABS, and not in the name of the GIB, means that should the ABS fail to pay its annual interest or full value at maturity for any reason, then investors seek compensation in the value of the collateral rather than from the UK government. For this reason, ABS are considered ‘off-balance sheet’ for the issuer, or unconsolidated with existing debt as a result. Consequently, it is logical that ABS issuance should not contribute to the UK public sector deficit, allowing the GIB to access financing earlier than currently planned.

A similar proposal was made by Ernst & Young in 2010.²¹ However in that case, banks would have originated the loans which would then have been sold to GIB to be pooled together as collateral for the issuance of a bond. The problem with this structure – and perhaps why the government did not adopt it – was the lack of control GIB would have had over the quality of the loans. But events have moved on since then: banks are not lending to the degree desired and GIB is starting to lend direct itself. GIB can then control the quality of the collateral and, using the Agency/ABS model, can use that collateral to borrow from the capital markets independently of the UK government.

Other potential innovations

Should the GIB follow the Agency/ABS model there would also be other positive impacts. In theory there is no limit to the amount of funds global investors could provide and pass on to green companies in the UK. This may also have the benefit of providing credit to smaller and middle-sized UK green companies, currently starved of credit by UK banks. It carries with it at least the hint of greater economic growth, green growth and more jobs.

In addition to borrowing on a collateralised basis (Agency/ABS), the GIB could also enable other financially sound companies to borrow at a lower cost than normal with a GIB guarantee. The GIB could hold a portfolio of guarantees which, because they are diversified, would be considered lower risk than borrowing in its own name. In this way, it could guarantee a larger amount and attract more private finance to the green sector. This avenue is worth exploring further.

There seem to be two current concerns within government regarding the GIB's powers to lend and to guarantee debt. The first is that in providing debt and equity finance, GIB may crowd out commercial banks once they are able to return to the market. Secondly, GIB may become an enduring public sector bank, less well run than a private sector bank.

There is one solution that may meet both these concerns: the possibility of a sunset clause. The GIB's investment banking operations (debt and equity finance) could be privatised after, say, ten years, if there is no longer a public need for a green investment bank with agency status – i.e. if major green infrastructure funding was completed and it was believed that commercial banks could meet the new green challenges on their own. Green finance would be fully integrated into commercial banks' operations. Any direct GIB debt could be grandfathered to avoid disruption.

However, the path ahead is not smooth. The EU has authorised the GIB to lend for low-carbon investment only for four years. Additionally, some may be concerned that the green companies the GIB assists may be regarded as receiving state aid. However, the GIB is acting solely as a catalyst for private finance, making loans when commercial loans are not available. Additionally, the GIB is only lending as the banks are constrained by the financial crisis and Basel III risk restraints. Further, the GIB would only be providing low-cost finance because it is more efficient for it to fund this way, in a similar vein to KfW. Finally in the context of state aid, it is important to retain sight of the big picture – which is that all the UK is aiming to do is transition to a low-carbon economy and mitigate the impact of climate change.

Adapting to climate change and new norms of energy provision is not easy. It requires a change of mindset and new modes of thinking and operating. It additionally requires substantial new infrastructure investment, including energy infrastructure which will not only provide low-carbon but also lower cost energy. Overcoming this challenge requires having the courage to be a leader, and the GIB is best placed to provide that example. Being prepared to do this means that it will also secure globally the benefit of first-mover advantage.

National Infrastructure Bank

The Government's National Infrastructure Plan outlines a vision and six areas of commitments: transport, including aviation, energy supply, broadband, water, flooding and coastal erosion, and waste.²² Significantly, these are all green issues. An alternative option to privatising the GIB in the future

would be to bring the National Infrastructure Plan under the wing of the Green Investment Bank.

Long-term investment in the UK's infrastructure requires policy stability, consistency and continuity. A plan overseen by an independent agency such as the GIB should help to ensure exactly that stability, putting an end to the volatility and uncertainty of different political parties in successive governments following different agendas.

Public participation

Sourcing finance for the UK's transition to a low-carbon economy is critical. Agency/ABS funding may do the heavy lifting but the public can contribute too. Indeed it would be very positive for the public to participate in this transformation as much as possible.

Green cash ISAs

Banks and building societies could offer green cash ISAs, with the funds feeding directly to the GIB; the customer would know that their funds would be fully applied to environmental projects. To attract this investment, the government would provide ISA status and so there would be a tax benefit to the deposit returns.

Green energy victory bonds (National Savings Bonds)

The struggle to mitigate climate change can be seen as a war; 'green energy victory bonds' could be as relevant today as the Victory Bonds that were offered during the world wars. In fact legislation is currently being proposed in the US for Clean Energy Victory Bonds. These would be similar to green cash ISAs, with the funds going directly again to the GIB for green projects. They would be issued by National Savings and Investments (NS&I) and, with longer maturity dates than ISAs, would carry a higher yield. They too would carry a tax lift to attract investment.

Local authority infrastructure bonds with tax incentives

In 2011 the Chancellor suggested that financially sound local authorities should be encouraged to borrow more from capital markets. The funds raised by the bonds issued could be used for local infrastructure projects. The bonds could appeal to investors because they fund local projects, directly benefiting local people. Additionally, because they invest in green infrastructure, they could be provided with a tax incentive. In this way they would be similar to

the Build America Bonds recently made available in the US. The GIB could play a role in coordinating these projects.

Infrastructure bond funds

Should the GIB be able to access substantial long-term funds from the global capital markets, and should other countries' green investment banks, or similar, be able to do the same, there will be liquid financial markets for green infrastructure bonds of various maturities. National Savings and Investments (NS&I) and possibly high street banks may want to market to the public funds that invest in green infrastructure bonds, thereby establishing another source of funding for the government. Such funds may well be attractive to the public, not only because they would be green and finance worthwhile projects, but also because paying an interest rate of 2 per cent to 4 per cent and backed by a government agency, they would be a relatively high-yield and low-risk product – more attractive than the 0.1 per cent most savers receive ordinarily on their deposits at banks. An additional attraction could be ISA status, providing a tax incentive or tax treatment similar to Venture Capital Trusts (VCTs).

Conclusion

No one is under any illusion that the challenges of the low-carbon transition are substantial. However, for an innovative and creative Green Investment Bank, the potential rewards are great. Not only could the GIB source hundreds of billions of pounds of green investments, it could also become the custodian for a stable and consistent National Infrastructure Plan. Through developing an innovative Agency/ABS model, it could access hundreds of billions of pounds without increasing the budget deficit. It could help to ensure energy security and build a low-carbon economy while also providing the private sector with high-quality, long-term infrastructure assets. Through, for example, the provision of guarantees, the GIB could not only foster green growth and green jobs, it could also provide credit to smaller and medium-sized green companies in the UK.

To achieve all this, the GIB needs to be ambitious and in terms of funding, it needs to think globally. Now is not the time to think of reasons not to act; rather it is a time to be innovative and to lead.

Notes

- 1 HM Treasury, *National Infrastructure Plan* (2011), p. 7.
- 2 *Ibid.*, p. 97.
- 3 Basel III is a global regulatory standard on bank capital adequacy, stress testing and market liquidity risk agreed by the committee of global banking supervisory authorities.
- 4 Solvency II is an EU Directive that codifies and harmonises the EU insurance regulation. Primarily this concerns the amount of capital that EU insurance companies must hold to reduce the risk of insolvency.
- 5 Climate Change Capital and E3G, *Accelerating Green Infrastructure Financing: Outline proposals for UK green bonds and infrastructure bank* (March 2009); Policy Exchange, *Delivering a 21st Century Infrastructure for Britain* (September 2009).
- 6 Ernst & Young, *Capitalising the Green Investment Bank* (October 2010), p. 5.
- 7 At the All-Party Parliamentary Group on Climate Change discussion on 'The Future of Green Infrastructure Investment' on 21 November 2012, Ian Nolan (CIO) stated that the GIB aimed to be an 'enduring institution' and so the early years were important.
- 8 Written Ministerial Statement by Vince Cable MP, Secretary of State for Business, Innovation and Skills, 30 October 2012.
- 9 Sally Bakewell, 'UK Green Investment Bank strikes its first offshore deal', Bloomberg, 20 December 2012.
- 10 'Green bank powers up', *Financial Times*, 29 November 2012.
- 11 Lord Smith of Kelvin (Chairman) was at ICFC (now 3i) until 1982. Sir Adrian Montague (Vice Chairman) is the current Chairman of 3i. Shaun Kingsbury is the new Chief Executive of GIB and was an adviser to 3i. Ian Nolan (Chief Investment Officer) was also CIO at 3i.
- 12 Shaun Kingsbury came from Hudson Clean Energy Partners. Tom Murley (non-executive director) is at HgCapital. Also, Tessa Tennant (non-executive director) co-founded the equity Jupiter Ecology Fund.
- 13 Bank for International Settlements, *International Debt Securities* (June 2012) and *Domestic Debt Securities* (March 2012).
- 14 World Federation of Exchanges, *Market Highlights for the First Half Year 2012* (23 July 2012).
- 15 'Bonds switch signals end of cult of equity', *Financial Times*, 19 November 2012.
- 16 Towers Watson, *Top 300 Pension Funds*, September 2011.
- 17 *Ibid.*
- 18 Steve Johnson, 'SWFs go shopping for managers' FTfm, 16 July 2012.
- 19 The ten-year gilt currently yields just 2.11 per cent while the thirty-year yields just 3.32 per cent (4 January 2013).
- 20 Possibly secured in a similar way to a project finance loan.
- 21 Ernst & Young, *Capitalising the Green Investment Bank*, p. 14.
- 22 HM Treasury, *National Infrastructure Plan*, p. 6.

Empowering a Shift to a More Circular Economy

Ben Earl

We are at the beginning of a resource revolution. The decline in commodity prices seen over the whole of the twentieth century has been completely reversed in just the first ten years of the twenty-first. The limits of finite fossil fuels, combined with the end of an era of cheap labour and abundant materials, mean that traditional models of wealth creation need revisiting. With a projected 9 billion people on the planet by 2050 a resource crunch is looming.

Much is made about how the economy can be lifted out of recession. The debate centres around the degree of austerity needed to cut the deficit versus the amount of fiscal stimulus needed to promote growth. What is plain to see is that high oil and commodity prices are a significant factor associated with the flatlining of the UK economy. If you compare the current economic cycle to the end of the 1930s' recession then it is these high prices that are seriously hampering a traditional economic recovery.

The green movement of course has been predicting this for some time. The oil shock of the 1970s was an early pointer, but through initiatives such as 'One Planet Living' and other sustainability programmes the alarm bells have been ringing over rampant consumption of natural resources. Despite this, the drive for change in consumer behaviour has had limited success. If we take the challenge of waste in society as an example, huge strides have been made through recycling to reduce the amount of waste sent to landfill. The landfill tax has been the crucial driver here. For business, the landfill tax regulation, with annual increases and fiscal certainty, has been understood and responded to. However, this shift happens at the 'end of pipe', and we remain constrained by operating within an economy which is take-make-dispose, and therefore linear in its make-up.

What would happen, however, if we focused on redesigning products and business models to reflect these modern realities? Instead of waste products, items would be made that could be easily disassembled and regenerated. Business systems would emulate living systems and collaborate to cycle

materials and components, meaning waste would be eliminated by design. Householders would receive the latest styles and gadgets through rental or performance contracts that would encourage trends to be easily refreshed whilst energy and resource productivity was integrated from the start.

Progressive thinkers have long championed different economic models that reflect 'quality of life' indicators. There is evidence that shifting taxation on to polluting, non-renewable resources and removing it from low-carbon or sustainable technologies may provide a powerful lever for accelerating progress in these models. Progress towards these goals has been slow. The Treasury has not yet embraced the 'green economy' in a meaningful enough way, and as such, for example, the Green Investment Bank is unable to use its own capital to borrow.

A shift in system thinking

Policy-makers have legislated to place limits at the end of linear systems for decades. Examples include discharge limits to air, land and sea, disposal bans and taxes. These limits have driven necessary change and go to the very heart of what standards responsible government believe are necessary. In recent years significant consideration has been applied to rethinking the product supply system. The notion of the 'circular economy' allows maximum resource productivity alongside built-in waste reduction. By changing the very nature of our relationship with products and services it requires a parallel shift in perception, economic incentives and behaviour.

A circular economy is one that works on the principles of the natural world. Products are made from natural raw materials being endlessly reused from creation to disposal, with few ill-effects. If you think of a rainforest, the complexity of the ecosystem is sustained by the constant use and reuse of available resources. Strip back to the soil, and the foundation of the rainforest is actually quite thin. The ecosystem is so efficient that waste is at a minimum, yet just look at the abundance of life it supports. For so much of our current economic activity unsustainable systems are maintained which ultimately degrade life support systems over time.

The use of instruments to promote such a system shift requires some progressive and potentially radical thinking. In a Green Alliance report at the time of the last election the Liberal Democrats received three green lights by offering the strongest set of policies on climate change, green taxation and greener living. Most famous was the strand of environmental policy running through each chapter of the party's manifesto. It is once again time for the Liberal Democrats to exhibit new thinking and put in place policies that

encourage action to address the worst prognosis of environmental degradation ever reported in recent months.

Economic instruments, along with suitable technical requirements, could play a crucial role in laying the foundations to enable a substantial shift to take place in business thinking. Reflecting the challenges posed by the nature of globalised markets, international agreement and partnership is needed. Tax incentives leveraged into research and development, alongside the development of ‘waste hierarchy taxes’, would effectively shift the economy to address the increasingly efficient use of resources – similar in outline to the progress seen as a result of the landfill tax.

It is well known that reuse is the most sustainable waste option – yet economic levers do not reflect this. By using these instruments, factors such as product take-back become even more attractive to business. Taking those increasing commodity prices into consideration, it is already starting to be acknowledged that recovering raw materials is cost-effective. The complicated construction of many products, including the large number of raw materials in trace form they contain, makes reprocessing very complicated. Designing products with eco-design in mind will not only aid the material recovery process but also lead to a clearer understanding of key issues such as water and carbon usage at various points in the supply chain.

The circular economy, however, also requires different ways of working. It is perhaps obvious to see how retailers can work with suppliers to deliver new methods of resource efficiency – but what happens when companies deem it most efficient to work with their competitors? This may be seen as an unusual step in our highly competitive market, and may pose competition issues which will need to be addressed. Most likely are shared facilities, involving different tiers of the supply chain to enable close collaboration. Government can play a role here with an industrial policy designed to promote this collaboration. Financial incentives in planning policy would help shape the industrial parks of the future, built with more resilience and collaboration as fundamental to sustainable business practice.

The changing nature of taxation

The Liberal Democrats already believe that a key step in creating an environmentally sustainable economy is to establish a system of taxation which rewards activities which are non-polluting and resource-productive, achieved through a gradual switch from taxation on income and employment to taxation on pollution and resource depletion. At recent conferences the party has reaffirmed this commitment, with a call for the government to set a

target of securing not less than 10 per cent of its revenue from environmental taxes by 2015, thus positioning the UK amongst the better performing members of the EU.

Speed is of the essence here, particularly as sectors of society such as those exploiting traditional fossil fuel sources will seek to challenge this shift to a more sustainable trajectory. The December 2012 Autumn Statement contained an announcement of a consultation on new tax incentives for shale gas, despite the Climate Change Committee (who advise on the legally binding climate targets within the Climate Change Act) stating that a high-gas scenario would be ‘completely incompatible with climate change targets’.

Walter Stahel is credited as being one of the founding fathers of industrial sustainability. Coining the phrase ‘cradle to cradle’ in the late 1970s, Stahel has called for a shift from labour to resources. He argues that this shift is good for employment as less than a quarter of overall employment is dedicated to the procurement of resources, with a subsequent three-quarters employed in the manufacture of the product itself. The reverse is true for energy; three times as much energy is used to extract virgin or primary materials than in the manufacturing process. Placing reused rather than virgin components in manufacturing products can therefore use less energy through a dynamic supply chain which, by the nature of the associated value-added processes, can provide more employment opportunities.¹

A logical argument then follows that taxing the consumption of non-renewable resources instead of labour will promote a circular regional economy instead of a linear global one; increasing the costs of fuel-based transport by road, air and sea will favour local and regional solutions. In the same way, the local reuse of components will reinforce the competitiveness of these value-preserving business models. In the UK this thinking needs to be injected into the industrial policy led by the Department for Business, Innovation and Skills (BIS).

Government policy in the UK and across the developed world is, however, in most cases heading in the opposite direction. According to an International Energy Agency report in 2010, fossil fuel subsidies across the world in 2008 amounted to US\$557 billion compared to just US\$46 billion for renewables. The report argues that a phase-out of fossil fuel subsidies would enhance energy security, reduce greenhouse gas emissions and bring immediate economic gains.²

Product rental and collaborative consumption

Dame Ellen MacArthur famously gave up her sailing career to, in her words, ‘rethink the future’, quoting the resource constraints of long-distance

sailing as a clear parallel to the challenges outlined here. The retailer B&Q has signed up as a founding partner of the Ellen MacArthur Foundation, recognising the need to invest in new business models such as product rental and collaborative consumption.

Applying rental models to power tools or appliances builds on the success of the mobile phone operators and delivers to the customer a quality, ready-to-use product at point of need. Using a power drill as an example, the average use is just ten minutes per customer, per year, so why do we all need to own one? Renting a drill for each use makes much more sense. Renting products and using refurbishment on returned products, alongside other new models such as collaborative consumption, means that efficiencies are maximised. This process emulates nature by ensuring that the manufacture of products minimises the loss of energy and materials, whilst concentrating on convenience of service and lowering costs to the consumer. These proposed changes partly reflect the degree of risk that exists to global supply chains, demonstrated by volatile commodity prices, but also a desire to remain ahead in effective business planning. A circular economy therefore is a more predictable industrial system that is restorative in its design.

The washing machine provides a good example. B&Q has for some time had an A-rated appliance policy, only stocking a number of appliances (including washing machines) with a minimum energy efficiency rating of A, to aid the customer in keeping energy bills lower. With the introduction of even higher standards (up to A+++)³ the business is now looking at ratcheting up those standards. The problem is that the purchase price also increases – yet higher end washing machines (those facilitating 10,000 wash cycles instead of just on average 2,000) in more households would save the consumer around 30 per cent in washing costs and the manufacturer about 180kg of steel and 2.5 tonnes of carbon over a twenty-year period.³ A rental model for washing machines could therefore lead to lower wash costs for each customer and an efficient material recovery process for the manufacturer.

A mindset change needs to be demonstrated through a model where access shifts from simple ownership to one where buying performance becomes a key driver. The retailer makes a profit on the contract formula and the consumer ensures they are a recipient of a higher efficiency, top-quality model in perpetuity. Progress has been made in a perhaps more obscure market, that of carpet tiles. Desso, a carpet tile manufacturer, has introduced a rental model for carpet tiles that ensures that returned tiles are reused in new products with attention paid to different stages of the supply chain to ensure a sustainable approach. The floor covering is provided with upgrades

to ensure customer satisfaction. The company continues to generate profits and deliver high levels of customer service. Indeed Desso wants to go further, and by 2020 it is aiming to have its processing and manufacturing processes completely powered by renewable energy.

Accelerating the transition

The Ellen MacArthur Foundation believes that inspiring a generation of young people to grasp the opportunities of the future and become excited about subjects like science, technology, engineering, maths and design lies at the heart of the transition. They believe that the circular economy offers a coherent framework in which young people are inspired to design things differently and revolutionise our economy to one in which the long term will be more effective and efficient.

This turns what is often currently seen as an insurmountable challenge into future innovation and employment opportunities. The challenge is that this often comes up against the narrow restraints of the National Curriculum. New thinking is needed to equip young people with the skills to become creators of the new business models of tomorrow. The circular economy should therefore be included in existing curriculum activities through new educational initiatives with economic and environmental sustainability intertwined.

Internal communication within the business sector is equally important from the board room to the shop floor. Too often leadership occurs at the top of an organisation, but this is not supported at the grassroots level. Employees need to understand the reason for different models and to be inspired in the implementation of the subsequent changes that follow. With the economy having been awash with cheaply produced and supplied products with scant regard to resource efficiency, the need to make store staff aware of the challenges we face on resource costs and to inform them of solutions such as new rental models becomes very important. A clear reason to move shop floor staff, buyers and other procurement teams to a new 'normal' requires thinking and reward. A clear example is in relation to chemical additives that might work against the ease of reusability in future disassembly. Assembling a truly 'cradle-to-cradle' product involves ensuring that its content and components can be fully disassembled and that its chemical contents do not pose blocks in this process. Buyers that have been used to (what is on paper) the cheapest ingredients will not have factored in the next stage of the process beyond the sale of the product.

This comes back to leadership, catalysing the mindset change needed by business. Much recent work on 'followership' has suggested that the act of

leadership is less about instructing or even inspiring; it is more about ensuring that those under your direction have the tools to make the changes. This is particularly challenging in the current economic climate of job insecurity, flat retail sales and wider eurozone instability. Most boardrooms facing these headwinds have rightly focused on daily essential spending, and in many cases investment for new business innovation has been particularly badly hit.

Innovation therefore requires suitable investment, again related to the business strategy to improve skills, enable new methods of collaborating and ensure a sustainable transition to a more resilient economic model. The recent report to government by former UK Deputy Prime Minister Michael Heseltine⁴ once again made the case for tax credits for research and development. The circular economy and the new investment models needed to accompany it are important to be part of this R&D call to arms. Business spend in this area of the economy will build resilience to price and resource volatility and once again be good for employment.

Marketing the change

Inspiring consumers is an equally important part of the challenge. A decade of education around the resource, ecological and climate-related problems faced across the world has been followed by a decade of persuading people to do something about them. Awareness has been seen as the easier part, probably because action is often perceived as being against consumers' interests; mass market transition has been slow.

A new era of communication with consumers is therefore important. We need to shift expectations about the level of change needed in society. In the 2008 WWF publication *Weathercocks and Signposts*, the authors concluded that any adequate strategy for tackling environmental challenges will demand engagement with the values that shape the decisions we make.⁵ Underpinning the shift to a circular economy is the notion of a 'new norm', based on a rational argument. Clear explanation of the current linear nature of supply chains and its obvious vulnerability provides a logical argument to illustrate the need for change.

Crucial to any changes is the perception of greener products. We need to shift expectations in the performance of so called 'eco' products. Indeed, we need to go further. The words 'eco' or 'green' need to be dropped in favour of terms such as 'optimal' or 'innovative'. In most cases eco-products have been seen to be poor substitutes; studies have shown that they often deter more consumers than they inspire. The environmental movement has often painted a picture of retreat from modern living and a climate of sacrifice.

The circular economy, in contrast, paints a very positive picture for consumers: better-performing products, including more beneficial features, rented or purchased through more user-friendly business models. Correctly positioned and effectively marketed, this vision can be sold to an audience that understands the limitations of the way we currently do things. Recycling has been embraced as a mainstream activity and so can the concepts laid out here. No one questions the mobile phone rental model, for example, and so new thinking can be applied to line up better-performing products, cheaper production models and profits generated in different ways.

Action by government

Recent acknowledgement by government of a potential resource problem has come in the form of the Resource Security Action Plan jointly produced by Defra and BIS.⁶ Framed very much with ‘opportunity’ rather than ‘risk’ in mind, the document focuses on the need for resilience, recognising the serious threat to economic recovery that stems from our wasteful linear economy. It is welcome that the government is working with the Circular Economy Taskforce. Set up with the support of leading businesses such as Unilever and BASF, and managed by the Green Alliance along with WRAP, this body is clearly framed to produce practical recommendations that aim to shift thinking and policy-making.

It is clear that pressures on natural resources are already concentrating minds within business. The role of government is to help remove barriers to good practice, particularly where it may not be in a company’s own direct interests to act – for example in the complex regulations around waste handling, even if the waste is destined for reuse. As in many emerging technologies the early pioneers need supporting to build well-constructed markets. Priorities for future Liberal Democrat policies include:

- A shift in taxation from employment to resource use – through the reduction of employers’ national insurance, making it cheaper to hire staff, and a corresponding increase in taxation on raw materials. This combination will accelerate the price differential in favour of closed-loop models whilst at the same time being potentially fiscally neutral.
- The transition of the landfill tax into a ‘waste hierarchy tax’. This hybrid version of a waste tax will progressively increase as you move down the waste hierarchy, ensuring that the more environmentally responsible options, such as ‘closed loop’ and product reuse are more financially attractive, whilst at the same time penalising the most polluting options such as incineration and landfill.

- Support for new innovative business models through a cut in VAT for closed-loop products – products designed to be reused, with future reassembly designed into the process, or which are as close to fully recycled content as possible. This will be a significant driver in the creation of new markets for recycled materials.
- Opening up the National Curriculum to new thinking to enable the designers and brand consultants of tomorrow to recognise the shift towards a closed-loop economic system. This will need to influence science, IT, marketing and economics to truly reflect the business models of tomorrow.
- Further work on the ‘Green Claims Code’, with measures to ensure that business adheres to clear terminology. Developed in partnership between BIS and Defra, these guidelines should eradicate ‘greenwash’.
- The phasing-out of fossil fuel subsidies to ensure a smooth but clear direction of travel towards a low-carbon economy. A review of field allowances, the tax breaks given in recent budgets to develop oil and gas fields in the North Sea, is one example.
- A change in industrial policy to encourage greater supply chain collaboration between SMEs and the larger companies they supply. A review of competition law to ensure that logical collaboration between different business sectors is not inhibited, whilst ensuring suitable safeguards to prevent cartel activity.
- Tax breaks to promote research and development into the circular economy. Although capital allowances for suitable investment are already available, in future these should be clearly focused on promoting ‘closed-loop’ activity.

Conclusions

The onset of increasingly volatile energy and resource costs, coupled with a rapidly increasing number of global consumers, is driving a significant change in the way in which business will be conducted in the future. Policy-makers have responded, often in isolation, to each of the employment, growth, climate and resource scarcity challenges without joining up their measures. The corresponding models and rules by which our economy works therefore need significant adjustment to turn the new approach into an advantage for the UK.

The circular economy by its very design offers the opportunity to paint a positive picture for manufacturing – which, at its heart, contains the ability to create jobs, deliver resilient economic growth and mitigate resource and environmental risks. But to get there we need a gear change in terminology

and business innovation. Government can play an active part by providing tax breaks and shifting taxation on to those things we want to reduce and away from those that as a society we need more of.

Walter Stahel describes the circular economy as ‘symbiotic’, aligning a series of levers that naturally build in the positive features that politicians of all colours increasingly espouse for the economy. Perhaps just as crucially, it makes common sense to the public at large and still leaves room for the progressive innovation that inspires the consumer and ensures that business can prosper.

Bold leadership on industrial policy is required by all involved. This call has been answered by Kingfisher plc, the owner of B&Q. As part of the Net Positive business plan a target has been set to deliver 1,000 products with closed-loop credentials by 2020. This is a significant challenge as the business seeks to define, implement and report on these changes. The other founding partners of the Ellen MacArthur Foundation are setting similar goals; together, this will help to set a clear blueprint showing the way to the low-carbon economy that needs to be developed.

Set out in this chapter are pointers to some practical interventions that politicians can design to aid this process. BIS has already shown that longer term thinking is needed in relation to the banking sector; the splitting of the functions of the retail and investment banking arms will ensure more stability to taxpayers. Will a similar shift in industrial policy lead to adequate support being given to wean the nation off short-term models that lead ultimately to higher prices and longer term economic decline? Is new thinking to fully embrace the circular economy a real possibility? The Liberal Democrats within the coalition have the radical thinking and environmental heritage to ensure this shift takes place, but they need to make the case loud and clear to ensure that it does.

Notes

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A World Without Waste – Achieving a More Resource-Efficient Country

Susan Juned

The demand for resources is increasing. As the rest of the world strives and achieves the standards of living that we take for granted, consumption levels and price levels will continue to rise. Meanwhile climate change and environmental degradation are realities that can only become worse. The conundrum is how to achieve a competitive economy that continues to provide a high standard of living for our residents but also addresses climate change and lowers environmental impacts.

What is resource efficiency and why is it important?

The UK has high imported material and energy dependency. As a result, access to adequate sources of raw materials and recycled materials and the security of energy supplies will have an increasing impact on future economic growth. Environmental policy that is designed to prevent waste and conserve resources should therefore not be seen as a constraint on business, but rather as an essential part of ensuring future competitiveness and resilience. Using resources more efficiently produces savings that can be reinvested and prevents over-dependence on particular sources of raw materials.

The business practices of the future have to consider ways to use resources such as metals, minerals, water and fuels in a more sustainable manner. The consumption of all these is a part of the standard of life that we have come to expect, but they must be conserved and used efficiently, or be replaced by more sustainable alternatives if that standard is not to be eroded for ourselves and future generations.

Across the world competition is increasing for many of the resources that we currently use in manufacturing products. It has been estimated that by 2030, the world will need at least 50 per cent more food, 45 per cent more energy and 30 per cent more water than it currently uses – all at a time when environmental boundaries are throwing up new limits to supply.¹

A 2011 article in the *European Financial Review* claimed that there are increasing signs of a crisis in natural resources being shown by the Commodity Price Index.² The index is a measure of price movements for twenty-two basic commodities and has more than tripled since 2002. Price volatility, upward price trends and growing scarcities pose a serious challenge for the security of global supply chains. In addition, the treatment of waste, the extraction and processing of raw materials and the generation of energy from fossil fuels all impact negatively upon the environment and add to the dangers of climate change.

Recognising the importance of resource efficiency is essential as the start of the journey required to address the whole-life impacts of the products we use and to find sustainable solutions. Government policy needs to set the UK firmly on the journey towards a zero-waste low-carbon society where resources are valued and efficiently used. This journey should aim to see waste production and water use minimised, successful resource-efficient yet cost-effective businesses encouraged, the environment protected and resource and energy security ensured.

What types of benefits can resource efficiency bring?

A report from the EU in 2011 recommended that increasing resource efficiency will be the ‘key to securing growth and jobs for Europe’.³ A strategy has been agreed that aims to make the EU a ‘circular economy’, based on a recycling society where waste generation is reduced or used as a resource. Taking a similar route in the UK to improve resource efficiency is one way of limiting the growing economic costs to business of importing materials and sending too many usable materials to landfill.

A 2011 Defra-commissioned study into business resource efficiency identified that UK business could make significant savings by being more efficient in the use of raw materials and by preventing waste – often for a relatively small-scale level of investment.⁴ The study recognised that the efficient management of resources will protect industry from shortage and security threats and will also protect the environment and reduce the impacts of climate change. However, the study also noted that there are often difficulties involved in estimating the hidden costs of resource efficiency measures, which emphasises the need for specialist advice and assistance.

Using resources more efficiently has clear economic benefits for companies, and an environmental policy that supports resource efficiency is an essential ingredient in ensuring the future competitiveness and resilience of the UK economy as a whole. Businesses understand that they can make

savings by using resources more efficiently and more are recognising that they should plan to avoid an over-dependence on those raw materials that are likely to be in short supply in the future or originate from an insecure source.

Small businesses may have an even higher level of exposure to rising resource costs and will need specific support and access to credit to enable them to invest in measures that mitigate the risk of higher bills for energy for power, heat and transport, leading to reduced competitiveness. Larger process industries that are heavily dependent on power are also vulnerable to price increases in fuel as well as other resource costs. These larger businesses should be considered as key partners in disseminating best practice to their supply chain in areas such as industrial water management, energy efficiency, zero-waste concepts, recycling and reuse and more resource-efficient technologies and production systems.

Government can ensure that data and information is freely available to business and that considered regulation is put in place. Government will play a vital role in ensuring that the development of resource management policy is twin-tracked with innovative research into the low-impact materials of the future and the engineering solutions required to reduce the materials used in products and find substitute materials. This has to be done with some urgency to prevent the shortage of materials becoming an insurmountable problem.

The material we waste

The UK lacks reliable waste data, with the exception of the waste (mainly from households) collected by local authorities. However, the best estimates from Defra indicate that the UK produces about 280 million tonnes of 'waste' materials every year. The amount is declining but the UK still produces more waste than the top performing European nations.

Local authorities collected a total of 23.5 million tonnes of household waste in England in 2010–11, of which 41.2 per cent was recycled, composted or reused.⁵ The amount sent to landfill has fallen in recent years, but 11.4 million tonnes is still disposed of in this way each year. However, household waste accounts for a small fraction of the total waste stream.⁶ The commercial and industrial (C&I) sectors produce approximately 24 million tonnes each per year. The volume being recycled by this sector has risen but 24 per cent of C&I waste was still being sent to landfill in 2009. Small businesses employing less than fifty people are estimated to account for 35 per cent of the waste in this sector.⁷ None of these figures take into account the whole-life resource cost incurred through the volume of waste materials produced or water or energy used in the countries which produce the goods we buy or in their transport to the UK.

The cost of dealing with materials as waste is huge. According to WRAP the cost of disposing of the 18.4 million tonnes of food- and drink-related waste produced by the UK food and drink industry and UK households each year is around £17bn.⁸ And the breakdown of food and other biodegradable waste contributes to emissions which are a significant component of climate change.

Protecting our raw materials

The security of our future resource supply is an area of critical concern for the economy. For example, the so-called rare earth elements are a group of naturally occurring metallic elements that are used in a range of the technologies we take for granted. Their use in wind turbines and hybrid petrol-electric cars are particularly crucial to the development of the low-carbon, energy-efficient economy.

Organisations such as the Royal Society for Chemistry have warned for some time that there needs to be an increase in the recycling rates of speciality metals such as lithium if we are not to face the danger of a shortage of supplies in the future as the result of higher international demand, reducing supplies, unstable countries and the rise of Chinese domestic manufacturing and export quotas.⁹

These concerns have been echoed by several EU reports on the supply of rare earths used in magnets and electronics as well as materials used in agriculture and other industries. A list of fourteen economically important raw materials which are subject to a high risk of supply interruption has been identified,¹⁰ and initiatives to set targeted measures to secure and improve access to raw materials for the EU have been undertaken.¹¹

Increased efficiency of use, more recycling and the development of alternatives are necessary, but even if such actions are undertaken immediately there is likely to be a short-term gap in supply. Such a gap could have serious economic and business resilience implications if not addressed.

Managing our water

Water is essential to every aspect of our lives. The more volatile weather patterns associated with climate change heighten the need to reduce leakage, find ways to use water more efficiently and assess any future pressure on supplies. New water resources will need to be developed, and storage and transport addressed.

After two winters of below-average rainfall, large areas of the UK faced drought in early 2012 and then had to cope with excess. The measures taken early in 2012, when water companies, farmers, businesses and consumers

were requested to take action to prevent shortages, may become more common in the future.¹² Short-term measures such as hosepipe bans and other restrictions will not solve the long-term issue of water shortages caused by a growing population, changing weather patterns and commercial decisions.

Every person in the UK uses an average of 150 litres of water per day.¹³ By contrast, the amounts used in Germany and France are 125 and 110 litres per person per day. The Environment Agency estimates that water bills for manufacturing industry could be costing over 1 per cent of business turnover. The UK also has an ageing utility service infrastructure. Water leakage is a problem, but the ability to assess the condition of buried pipelines and cables without undue excavation of the ground in which they are buried is complex, and likely to become more so as the climate changes. Further research on assessing the condition of underground service infrastructure is required.

An approach that moves from considering water use in a linear fashion – in which water is imported, processed and exported as wastewater and storm water – to a more cyclic model of water management, with reduced import of water, high rates of recycling and reduced wastewater and storm water has been analysed and discussed as part of the Urban Futures research.¹⁴ Such approaches can offer water efficiency solutions provided that they are acceptable to people and take account of human behaviour. Greater awareness and information on methods to save water and an increase in responsible metering can help people and companies measure and manage their water usage effectively.

Energy security

The UK is facing a rising dependence on imported energy. Energy security will become of increased importance when the closure of ageing electricity generating plants is added to the impacts of climate change and increased competition for dwindling reserves as other countries improve their own standards of living. Reduced energy supplies or higher prices would affect all aspects of life in this country, from the services provided to the most vulnerable in our communities through to the ability to maintain competitive industry.

Government policy can be highly influential in encouraging investment in infrastructure and ensuring that energy generation capacity (including renewables) continues to be developed. Government can also do more to prepare business and the public sector to audit and address energy efficiency, introduce behavioural and operational change and use low-carbon replacements. At a local government level, planning policy as well as other policies and emergency plans have to anticipate the potential impacts of reduced energy supplies and increased climate change instability.

Whatever solutions are proposed they must be tested for resilience to ensure that they remain resistant to sudden change, take into account human behaviour and do not yield an unexpected negative legacy.

UK policy on material resources

The 2011 Waste Review was seen by many within industry to be lacking in aspiration, with an absence of targets and an over-reliance on voluntary agreements and responsibility deals as an alternative to regulation.¹⁵ The Review presented a move towards zero waste as simply an aspiration, even though the Scottish Government is planning its zero-waste regulations in a bid to make Scotland one of the highest performing countries for recycling in Europe. Included is a complete ban on municipal biodegradable waste to be sent to landfill by 2020, and requirements on businesses to present recyclable materials for collection.

Past government policies have concentrated on 'end of life' and have been too narrowly focused on local authority-collected waste. This focus on the collection and disposal of municipal waste has delayed the development of policy and data on business and industry waste; knowledge of the amounts, types and destination of waste materials from this sector remains limited. Landfill Tax has been a major driver for all businesses to reduce their waste, and there appears to be a marked decline in waste from the industrial sector. However, the trend is less clear in the commercial sector, and particularly the small business sector.

Many leading retailers are aiming for zero waste to landfill but small businesses struggle for assistance to support a recycling infrastructure that meets their needs and lack knowledge of the costs, opportunities and solutions available to them. The launch of a Business Waste and Recycling Collection Commitment by Defra in 2011 was designed to encourage local authorities to collect waste and recyclable materials from small businesses, open up household recycling centres to trade waste and work with commercial operators to develop contracts that cover small businesses in their areas. However, in a time of economic constraints on local government, further financial incentives would be usefully directed to encourage this sector. The former Business Resource Efficiency and Waste (BREW) Centre for Local Authorities (now a part of WRAP) worked to develop infrastructure and guidance and case studies using the vast experience available in local authorities.

The separation of the collection and disposal functions between two-tier local authorities and the reluctance of some councils to work across their administrative boundaries has encouraged more expensive and less efficient

collection services. In much of Europe commercial and industrial waste is not separated from household waste when it is of similar composition. Collecting small business-separated waste along with household-separated waste would allow for increased economies of scale and a better infrastructure to be developed.

A new approach to the use of all resources and the role of economic instruments in promoting a more circular economy is required. A report from the Green Alliance called for a greater emphasis on recovering and recycling materials, and also greater resource efficiency, improved design and durability of consumer products to assist resource recovery as a way of avoiding some of the damaging, environmental impacts of extracting resources and the negative aspects of waste.¹⁶

Zero waste is a concept that takes a closed-loop ‘cradle-to-cradle’ approach rather than a linear approach to the use and disposal of resources and takes nature as a model. Flows of energy, water and materials through the economy are mapped to preserve the value of resources wherever possible. A circular economy approach to resource use and developing innovation is a model that has been developed by the UK’s NISP (National Industrial Symbiosis Programme) organisation. By working with industry, the waste of one company can become the resource of another. The UK is recognised globally as a centre of excellence in the development of industrial symbiosis as a business model.

Resource efficiency was recognised by the EU as an essential part of their roadmap for the future.¹⁷ Future government policy must build on this roadmap approach.

Waste, resource management and planning

In their State of the Nation report 2010 the Institute of Civil Engineers concluded that the waste infrastructure of the UK was ‘requiring attention’, and that there was no excess capacity. Significant investment was required in the next five years.¹⁸ The government’s new National Planning Policy Framework (NPPF) proposals do not address waste or resource management, so further guidance on waste will not emerge until the government publishes its National Waste Management Plan in 2013. This lack of clarity could delay the delivery of essential waste management facilities.

Many local authorities do not serve a large enough population to justify planning for their own resource management facilities, and developing partnerships across administrative boundaries makes economic sense. The ability to plan for facilities that are of a larger than local significance

and the co-location of facilities has to be considered. Under previous regional arrangements, Regional Technical Advisory Boards (RTABs) consisting of local authority officers, businesses and environmental groups became repositories of expertise. The current remaining RTABs offer the opportunity for local authorities to utilise this expertise and demonstrate the ‘duty to cooperate’ requirement introduced by the government. However there needs to be further clarity about their role and funding.

Alongside a local approach there remains a vital need for strategic waste and resource planning and representative bodies, such as the RTABs, that can raise the profile of resource issues, focus on skills, investment, data-gathering and research and provide the vital policy-making advice and coordination that is required to build the green infrastructure economy. Such a body would need to work with Local Enterprise Partnerships and local authorities in each area to integrate infrastructure into local economies and encourage innovative UK manufacturers into the market.

A lack of good-quality reliable resource data makes it difficult to plan and finance innovative infrastructure. Much of the data for the commercial and industrial sector is estimated or extrapolated, and there is no ability to determine the type of industry producing materials or where they are located. Developing the ability to map where waste is being produced, by material type, geography and sector would assist the efficient exchange and utilisation of resources.

How do we become better at managing our resources?

An EU report on resource efficiency concluded that: ‘it is perfectly possible to produce more value with fewer inputs, to lessen our impact on the environment, and to consume in a more intelligent fashion’.¹⁹ But it also recognised that ‘millions of firms and consumers will need to be mobilised’ to achieve the required innovation and economic benefit.

The problems are compounded because the full costs of production and consumption are rarely reflected in the prices consumers pay for goods – which reduce the incentives to producers and consumers to innovate or change their behaviour. Information and science-based labelling, whilst useful for consumers, are not thought to be sufficient without other measures to reinforce the decision-making process.²⁰

Support for and the development of the concept of the circular economy will assist UK businesses to become more resource-efficient. The ability to bring together traditionally separate industries and organisations from all

business sectors with the aim of improving cross-industry resource efficiency and sustainability, involving the physical exchange of materials, energy, water and/or by-products together with the shared use of assets, logistics and expertise has the potential to boost economic prosperity.

A fundamental challenge to becoming resource-efficient is that waste, water and energy are currently perceived to be a small percentage of the overall costs of a business, and therefore managing them often takes second place to developing the core business, despite the fact that relatively simple measures can boost profitability. This is hard enough for large companies with dedicated staff, and even harder for small companies. Small businesses have particular problems which can include a lack of access to information, infrastructure, investment capital and management capability. Addressing these needs must be a priority.

The journey forward

The UK is on a journey towards a zero-waste and low-carbon society where resources are valued and reused and waste is only sent to landfill if there is absolutely no alternative. Preventing wastage of materials, energy or water has to become the norm.

The UK must develop a resource (rather than just a waste) strategy, where energy policy and climate change are taken into account and where the ensuing policy is tested for resilience to ensure that all solutions are resistant to change.²¹ Such a policy has to consider the whole supply network and ways to reduce dependence on a small number of suppliers. Boosting awareness of the need for resource efficiency in business processes and the recovery of materials from discarded goods is also required. Further development of closed-loop economic models has to be addressed.

An integrated approach must deal with all material resources, including collection, sorting, reprocessing and reuse mechanisms to ensure high-quality recycled materials. Cross-sector working and a holistic approach that considers all resources has to be encouraged across all industrial sectors, with a partnership between industry and government agencies to smooth out the inevitable barriers.

Future policy should include the complete ban of biodegradable waste to landfill, and a target to halve residual wastes from households and businesses. Such a target would require an increase in the capacity and infrastructure to handle resource recovery, and small and medium size businesses to recycle. Clarity is needed on the future of the Landfill Tax, with an extension that ties in with a ban on biodegradable waste to landfill and the drive to reduce

carbon emissions. Hypothecating the tax revenue to provide the finance required for waste minimisation and new infrastructure, through the Green Investment Bank, would benefit economic development.

The costs of acquiring and disposing of materials, water and energy are providing a strong incentive to businesses to improve their processes. However, more research and support for businesses would be welcome, as would more support and encouragement for ongoing UK university research to improve the recovery of rare earths from the waste stream and develop the materials and technologies of the future.

Resource efficiency requires an increase in capacity and infrastructure and adequate support from the planning framework for investment and innovation. Planning has to tackle the need for innovative closed waste facilities such as anaerobic digestion. Waste regulations have to be reviewed to encourage resource management and remove existing anomalies whilst safeguarding human health and the environment.

There is an increasingly urgent need to communicate the fact that resource efficiency is an economic opportunity that needs to be supported by a planning and strategy framework if it is to attract the investment and innovation required. Consideration has to be given to how materials are moved, what sites are available for facilities, what technologies and industries are available to handle the materials and how to ensure robust markets that are properly sustainable and resilient whatever the future brings. Real change, not tinkering around the edges, is required; consumers and businesses alike cannot afford a continued lack of action.

Notes

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