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Moving From Analysis To Action Champagne for the brain

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## Dr Mark Williamson, Director of Innovations at the Carbon Trust, believes the UK can take the lead in low carbon innovation

Low-cost 'organic' solar cells made from plastic; biofuels made from algae rather than food crops — these are just some of the exciting technologies UK companies are working on to tackle climate change and play a part in one of the world's most dynamic and rapidly growing markets.

Climate change is arguably the biggest challenge we face — last year's report from the Intergovernmental Panel on Climate Change outlined what could happen if we fail to cut our emissions sufficiently. There will be more extreme weather events, crop yields will fall, insect-borne diseases such as malaria will spread and glaciers will disappear, taking with them the water supplies that huge swaths of the world's population rely on.

As Sir Nicholas Stern's groundbreaking report *The Economics of Climate Change* explained, it is significantly cheaper to deal with climate change now than to wait and deal with the effects later. If we act now, it may cost a few percentage points of GDP to keep the level of greenhouse gases in the atmosphere at an acceptable level; but, if we delay, we could end up spending 20 per cent of economic output on dealing with the devastating consequences. As a result, increasing legislation is rightly being put in place to deal with climate change, from the Kyoto Protocol at the global level to the European Emissions Trading Scheme (ETS) and new European targets to reduce emissions by 20 per cent and produce 20 per cent of all energy from renewables by 2020.

Although the UK still lags behind other countries in terms of its use of renewable energy, there has been a significant increase in political commitment to decarbonising our economy in recent years. In fact, the UK is now leading the way with its Climate Change Bill, which is currently working its way through Parliament. This will be the world's first legislation to commit a government to legally binding targets on cutting emissions — at least a 60 per cent reduction from 1990 levels by 2050 and growing pressure for this to be amended to 80 per cent based on the latest scientific evidence. The Bill will also see the introduction of a new Committee on Climate Change that will set the UK's carbon budget in five-year cycles, ensuring that the requirement to deal with climate change becomes independent of short-term political cycles. This will be a significant step in reducing uncertainty and providing a more stable environment for investment in low carbon solutions. After all, it is the private sector that will ultimately invest in the new systems, infrastructure and services that will underpin our low carbon future.

Unfortunately there is no one 'silver bullet' technology that can cut our emissions to the extent required, while still meeting our diverse energy needs. We need a portfolio of different solutions across the economy — from power generation and manufacturing through to transport and buildings — to ensure that we can generate low-cost, clean energy and use it much more efficiently.

In the growing global market for low carbon solutions, different countries will naturally take the lead in developing technologies, based on their local skills, natural resources and energy needs. As Stern rightly notes, the move to a low carbon economy will involve significant costs, but it will also present attractive economic opportunities for those countries and companies that gain leadership positions.

The UK has significant competitive advantage in various areas and we need urgent and focused action to exploit this potential. We have excellent wind, wave and tidal resources, strong engineering expertise, particularly offshore, and a first-class academic and scientific base in relevant areas. With the right policies and investment we can harness these assets to generate valuable intellectual property, develop new export markets, build supply chains and create hundreds of thousands of new 'green collar' jobs across the UK.

Although the private markets will ultimately drive the move to a low carbon economy, governments also have a vital role to play in encouraging the necessary investment. Markets are successful in encouraging innovation where there is a strong consumer demand, for example in the automotive sector or in mobile telephony. However, climate change is a long-term societal challenge and the market for low carbon solutions has rather different characteristics.

For example, there is significant uncertainty about the future value of low carbon solutions, due to their dependence on regulatory factors and expectations about the future carbon price. They have to compete against well-established existing technologies and normally have higher upfront costs. New energy technologies also have long development timescales and require significant capital investment to get to market. Unlike cars or mobile phones, these technologies are often difficult to differentiate from each other as they typically generate, or reduce the use of, a commodity product, such as electricity. These factors are all potential disincentives to innovation and targeted action is therefore required. Left to its own devices, the market will almost certainly not deliver a low carbon economy as fast as we need it.

The Carbon Trust takes a unique approach to accelerating low carbon innovation and has supported the development of hundreds of different innovative low carbon technologies since 2001, from early-stage applied research through investment to large-scale demonstration and deployment. Our hands-on experience has highlighted the many and varied challenges which need to be overcome.

The conventional view of innovation begins with academics coming up with a breakthrough idea; after building a laboratory-scale version, the invention, if successful, then goes through sub-scale and full-scale prototypes, early demonstration models, various stages of market testing and finally mass-market roll-out.

However, this 'technology journey' is only one part of the overall innovation challenge. Of equal importance is the 'company journey' which must take place in parallel. Most innovations emerge from small teams, for example in a new company spun out from a university department. To commercialise the technology, the company needs to bring on board the right mix of commercial and technical skills, build successful partnerships, protect its intellectual property and, most importantly, attract investment at various appropriate stages along the way.

Breakthrough technologies also need to navigate an associated 'market journey', to ensure that barriers to market development are addressed. A practical example of this is biomass heating, which offers significant carbon savings and can reduce heating bills, especially with the recent surge in oil and gas prices. The technology is mature but, despite having been used for decades in other European countries, it is not widely deployed in the UK, due to supply chain uncertainty and a lack of consumer awareness. Nearly half of all UK emissions come from heating systems and biomass offers one of the most cost effective alternatives to fossil fuels, so it is essential that these market barriers are overcome as rapidly as possible.

Finally, alongside the technology, company and market journeys, there needs to be an associated 'regulatory journey'. Disruptive technologies often come up against regulation that actively discourages their development; for example traditional electricity market regulation favours large-scale generators, such as coal or gas plants, over smaller distributed generators, such as wind or solar installations. In the early years, low carbon technologies need regulatory support, for example through mechanisms such as the Renewables Obligation for electricity. However, these mechanisms also need to encourage costs to come down in the longer term; low carbon solutions will eventually compete without the need for subsidies, especially as the cost of conventional energy sources continues to rise.

So what are some of the technology areas where the UK can take a leadership role and capture economic advantage? Our offshore engineering heritage and natural resources make us potential leaders in the use of offshore wind, wave and tidal energy. In fact the UK has more marine energy device developers than any other country and later this year we will have installed the most offshore wind capacity globally. Similarly, our strong academic base leaves us well placed in a range of areas; we have world-class research capabilities in plastic electronics, which could underpin a new generation of low-cost solar cells, and in algal biomass, which could provide sustainable biofuels that don't compete with food crops. Bold new UK policy-making could also drive us to become leaders in energy efficiency, through measures such as the Carbon Reduction Commitment for medium-sized organisations and the plan to make every new home 'zero carbon' by 2016.

It is encouraging that all the major political parties continue to push the low carbon agenda despite the current economic slowdown — this will be absolutely vital to ensure that the UK does not lose out on opportunities or take its eye off the carbon reduction targets which are so important. And the potential benefits are much wider than just carbon reduction — taking a lead in low carbon innovation will also improve energy security as well as bringing wider economic benefits.

As the scientific evidence on climate change continues to mount, we need to move urgently from analysis to action. Decarbonising our energy system will require a scale of deployment, investment and political commitment unlike anything in recent memory. By taking bold steps now, the UK can play a vital leadership role in tackling climate change and, in so doing, capture important competitive advantage, create new jobs and transform our economy.

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