Commission on Environmental Markets and Economic Performance

Report

November 2007

BERR
Department for Business Enterprise & Regulatory Reform

Department for Innovation, Universities & Skills

defra
Department for Environment Food and Rural Affairs

Commission on Environmental Markets and Economic Performance

Report

November 2007

BERR
Department for Business
Enterprise & Regulatory Reform

Department for
Innovation,
Universities &
Skills

defra
Department for Environment
Food and Rural Affairs

Contents

Preface

"… the most promising development is that new jobs, new industries and new exports come from rising investment in new, low-carbon technologies…. As the international community begins to build a long-term framework, as the European trading scheme expands into a global carbon market, a new low-carbon global economy will take shape.

I am determined that Britain will lead its development and maximise the opportunities of the new low-carbon economy. So, following the publication of the Stern Report, I announced the establishment of a new commission to make detailed proposals to do this and secure new jobs for Britain over the next 10 years. We will continue to ensure that Britain is at the cutting edge of discovery and development of environmental innovation."

Gordon Brown

[Source: *The Green Shift: Environmental Policies to Match a Changing Public Climate*, Smith Institute (2006)]

The Commission on Environmental Markets and Economic Performance (CEMEP) was established by the UK Government in the light of the Stern Review on the Economics of Climate Change.

The findings and recommendations of the Commission are set out in this Report. The Terms of Reference are at Annex A.

Membership

Commissioners were drawn from business, trade unions, academia and non-governmental organisations, and meetings were chaired jointly by the then Secretaries of State for Trade and Industry and Environment, Food and Rural Affairs, Alistair Darling and David Miliband. Ian Pearson and Malcolm Wicks, now Science and Innovation and Energy Ministers respectively, were also Members.

The Secretariat to CEMEP was jointly provided by the Departments for Environment, Food and Rural Affairs (Defra) and Business, Enterprise and Regulatory Reform (BERR – formerly DTI).

CEMEP's membership and Secretariat staff are listed at Annex B.

Audience

The conclusions in this Report are mainly targeted at Government because CEMEP believes that environmental market opportunities are heavily influenced and, in some cases, driven entirely by the policy framework set by Government. However, any credible plan to nurture environmental markets must also embrace business and other key constituencies. Consequently, the Report looks at the responsibility of other actors across the whole economy and, while this is formally a Report to Government, it is aimed at a much wider audience than Government alone.

Report structure

This Report sets out the actions that Commissioners believe should be taken by Government, business and others to drive investment and innovation in environmental markets in the UK, and in so doing seize the substantial opportunities for wealth and job creation.

The first part of the Report sets out the **Analysis** that underpins CEMEP's approach to promoting environmental markets, using the conclusions of the Stern Review as its starting point.

The second part of the Report develops the **Policy Response** – the case for designing and implementing policies in ways that will create a more credible and stable environmental policy framework giving business greater confidence about future environmental markets, and for using additional policy measures to support environmentally-orientated innovation directly.

The third part of the Report, the **Business Response**, then sets out the ways in which businesses will respond to this policy framework by investing in the new products, processes and services that will define a truly sustainable economy, generating wealth and highly-skilled jobs. It also addresses the role of employees, investors and consumers.

Acknowledgements

Commissioners are grateful for the support, encouragement and advice they have received from Ministers, officials and leaders in this field from business, trade unions, NGOs and academia. In particular, Commissioners would like to thank Professor Dennis Anderson at Imperial College London, Robert Gross at Imperial College London and the UK Energy Research Centre, Professor Michael Grubb and Harry Morrison at the Carbon Trust, and Dr Ralf Martin at the Centre for Economic Performance, London School of Economics, for their contributions to the debate. A special debt is held to the staff of the Secretariat.

Executive Summary

A transition to a low-carbon, resource-efficient economy is needed to meet the global challenges of climate change and sustainable development. There will be winners and losers, but there are considerable opportunities for those countries and businesses with the foresight to seize them.

These exist not only for businesses competing for market share in providing environmental goods and services, but across all industry and commerce as new approaches transform environmental performance and the way natural resources are used.

The Goal

By making the UK one of the best locations in the world to develop and introduce low-carbon and resource-efficient products, processes, services and business models, the country can attract the investment today that will help create tomorrow's prosperity and jobs, as well as contributing to a cleaner environment. These benefits can be achieved without a need to 'pick winners' or predict future market leaders, and whether or not the businesses involved are UK-owned.

The Challenge

Achieving this goal will require a policy framework that drives investment and enterprise in environmental markets in the UK and provides more effective support for the development and commercialisation of environmental innovations.

The policies required are not cost free. There will be a trade-off between short-term costs and the potentially huge but uncertain longer-term economic benefits in the form of higher growth and greater job creation than might have been achieved otherwise. This raises a set of practical and policy choices for governments.

On one hand, climate change and other environmental challenges can be seen as a cost, with policies determined solely on their cost-effectiveness based on what is possible now. Taking this short-term perspective results in policies that lack ambition and leaves the costs of developing new environmental technologies to others.

On the other hand, they can be seen as an investment opportunity, with the future value of innovation explicitly taken into account in the decision-making process. According to this view, profit-seeking firms will respond to the early adoption of demanding, flexible environmental policies by innovating to reduce environmental impacts at less cost, in order to gain competitive advantage. This in turn will feed through to the economy in the form of growth and job creation in the future, and will also leave it more resilient to risks arising from environmental uncertainties.

There is something in both views and different Commissioners had different perspectives. But it is wrong to underplay or ignore completely either the costs or the possible benefits.

It is the Government's responsibility to clarify which path the UK should follow by clearly setting out its priorities and providing leadership through policy making and its own actions. It will then be up to businesses, employees, investors and consumers to respond.

CEMEP welcomes the Government's commitment to making the UK a global leader in low-carbon and environmental markets. Recent policy developments, such as the Stern Review, the proposed Climate Change Bill and the announcements in this year's Energy White Paper on support for renewable energy, are important steps in the right direction to support that ambition.

But the policy framework needs to be developed further. Commissioners believe policies can too easily be framed by cost-benefit considerations that are too short-term. There needs to be greater understanding and institutional support across Government for

taking longer-term costs and benefits into account and explicitly focusing some policy measures on harnessing market dynamics and innovation in meeting environmental goals.

The Policy Response

Policy needs to be designed to enable business to respond in the most cost-effective way but also to maximise the opportunities for wealth creation. While there may be tensions and trade-offs between these two goals, CEMEP believes an effective framework that takes account of both perspectives is possible. It should use the standard instruments of regulation or market-based incentives to internalise external costs and, in addition, support environmental innovation directly.

1. **Environmental Policy.** Measures such as putting a credible long-term price on carbon, better environmental regulations and removing barriers to commercialisation are needed to provide the appropriate signals to the economy.
2. **Innovation Policy: Market 'Pull'.** Market 'pull' instruments are required to support the larger scale deployment of emerging innovations by helping to create 'lead markets', which – in the environmental field – do not generally exist in the absence of policy intervention.
3. **Innovation Policy: Supply 'Push'.** These policies need to be underpinned by effective investment in the technologies and skills that will help develop competencies in the UK, and around which the new industries of the future will emerge.

Innovation support is needed because setting a price for carbon and other environmental impacts high enough to create the conditions for business investment in environmental innovation on the scale needed is politically difficult, and may not in practice be sufficient, or quick enough to create competitive advantage.

The three pillars of CEMEP's approach are discussed in more detail below.

In many areas, policy is set at European Union level and above, so this approach needs to be taken forward within a strong international context. Policy making at this level will help reduce concerns about impact on the UK's international competitiveness, and increases the scale and attractiveness of the market opportunities created.

Environmental Policy

Environmental policy is the critical factor for making investment decisions in environmental markets. Policy creates and shapes a market that would not otherwise exist. But this creates political and regulatory risks for businesses that they find hard to manage. These risks can be reduced by creating what industry groups have characterised as a 'long, loud and legal' policy framework, which:

- applies over a timescale that counts: not too short or too long;
- is clear and unambiguous and gives confidence that the policy direction will be maintained;
- is credible, which generally means legal, enforceable and likely to achieve the desired objective.

CEMEP has reviewed the UK's environmental policy regime against these requirements and has identified scope for improving and strengthening the framework in the following areas.

Setting credible goals

This is first and foremost a task for Government. But building a durable **national consensus** on goals by opening up and broadening the decision-making process can help reduce risk, increase credibility and provide protection against future revision. 'Credible' and 'consensus' need not mean unambitious.

Market-based instruments

Goals will only become meaningful to individual businesses when translated into the price signals against which investment decisions are made, through market interventions such as environmental taxation and 'cap and trade' schemes. Though not suited to all environmental impacts, cap and trade is favoured by business and governments, and the EU Emissions Trading Scheme has become the principal means of establishing a price for carbon.

However, great uncertainty – created by the combination of excessive price fluctuation and limited future price visibility, followed latterly by a persistently low price – has reduced the impetus for investment and innovation to cut emissions. CEMEP recommends that Government, working with EU partners as necessary, take urgent steps to **tackle this uncertainty**, or at least its effect on business.

CEMEP recognises differences in opinion as to whether making improvements to the operation of the scheme (building on the more vigorous 'policing' of allocations already in evidence from the European Commission) will be sufficient, or additional mechanisms (such as higher carbon taxes) are needed to guarantee a minimum cost of emitting carbon.

Regulation

Commissioners recognise that well-designed direct regulations can supplement pricing, but many existing regulations 'lock in' existing technologies and techniques by specifying best available technology. In areas such as product policy, setting outcome-based performance standards beyond the current best technology, but at a level agreed to be achievable through innovation, can incentivise performance improvements. CEMEP believes that Government should explore the scope for making greater use of such **'dynamic' performance standards**, which are progressively updated to take account of developments in the market, in order to drive product resource efficiency, particularly at the EU level.

CEMEP also believes legislation must be **implemented** according to a well-defined and unchanging timetable. The example of the Waste Electrical and Electronic Equipment (WEEE) Directive shows that delays or changes in implementation can undermine the ability of regulation to stimulate effective business investment.

Policy appraisal

Thorough impact assessment and cost benefit analysis is essential in environmental policy making. But policy appraisal tends to focus in practice on currently available solutions and current costs. Finding ways to **value the future benefits of innovation** in delivering better, cheaper solutions would enrich the contribution of policy appraisals to long-term economic performance.

Government should commission a study of how the long-term needs and opportunities from innovation could be incorporated into the appraisal process and guidance. Furthermore, Government Departments and agencies should address through their **science and innovation strategies** their role in promoting environmental innovation.

Barrier removal

Innovators can face a number of barriers in getting a new environmental technology to market, including **delays and uncertainties in testing and certification**. CEMEP recommends that Government review the approvals regime for sustainable construction products, identifying barriers and measures to put in place a more flexible, market-focused approach, in line with better regulation principles.

Regulated sectors

To increase the low levels of research and development and environmental innovation in the energy and water sectors, the economic

regulators should be given an **explicit remit to promote innovation** in support of sustainable development objectives.

Innovation Policy: Market 'Pull'

Investment risk is tied to uncertainty over whether the product or service funded by the investment will sell and, if so, at what price. The indirect inducements for innovation offered by environmental policy provide the necessary background for investment decisions, but direct support in the form of market 'pull' measures is needed to change the risk/reward ratio.

These measures will help create 'lead markets' and should focus on ways of making low carbon and other environmental characteristics a source of competitive advantage. Without favouring or presupposing a specific technological solution, they should promote rapid progress down the 'experience curve', with higher performance leading to higher sales and investment in capacity.

Public procurement

Procurement can provide a flexible and cost-effective tool for creating markets for products and services differentiated on the basis of environmental performance. As long as sustainability benefits are correctly valued, any extra up-front costs are only incurred when they are 'worth it'.

The **Forward Commitment Procurement Model**, whereby the well-informed procurer agrees to purchase a product that does not currently exist, at a specified future date, providing it delivers agreed performance levels and cost, should be used more widely in the public sector to bring forward innovative cost-effective solutions to environmental needs. Government can facilitate this by identifying where innovative solutions are needed; by establishing a 'Challenge' scheme to provide support, on a competitive basis, to improve the capacity of the public sector to use the model; and by adopting it for the 'Zero Waste Places' initiative to signal to the market a credible requirement for innovative waste management technologies.

Local action

New thinking and approaches often emerge first at local and regional level, where budgets, priorities and political will can more easily converge. Government should empower local area partnerships to use a range of policy measures to deliver **innovative, cost-effective solutions to local environmental needs**. Local action may have a small impact in itself, but can be the first in a series of progressive steps to transform a market sector. Successful initiatives can be replicated, with collaboration to create economies of scale.

Deployment support

Some products, such as centrally generated electricity, are intrinsically difficult to differentiate and will need other forms of support. Options include the use of **regulation to create early markets** and, particularly in the renewables sector, specific **sectoral deployment support** to help build scale and reduce unit costs for emerging environmental technologies. The nature and mix of deployment support measures will need careful attention if they are to drive innovation and investment in the UK rather than merely pay for imported technologies.

Innovation Policy: Supply 'Push'

Supply 'push' instruments involve support for research, development and demonstration (RD&D). While it does not overcome the gaps in funding that can be experienced at later stages in the innovation process, public support is needed to address well-established market failures that result in private sector under-investment in RD&D. But funds are finite and it is important that they are deployed effectively, taking account of market opportunities and UK strengths, as well as research capacity.

Coordinating capabilities

To leverage best overall value for money for energy- and climate-related RD&D, existing capabilities should be **coordinated** with new initiatives including the Environmental Transformation Fund (ETF) and the Energy Technologies Institute (ETI). **Synergies** should be sought between different strands of innovation support, using the specialist knowledge of organisations such as the Carbon Trust and the Research Councils, and **linking RD&D support to procurement opportunities**, including through the Technology Strategy Board's Innovation Platform approach.

The 'Options Approach'

As is it impossible to predict which technologies will be viable and competitive in the future, a portfolio of emerging technologies should be supported to **create options** for commercial deployment should they become economic. However, the option need not be exercised and support can be withdrawn at the end of each development stage beyond early R&D, if progress reviews show the technology is not performing well.

Prioritisation

Not all candidate technologies can be supported in the portfolio. Government should prioritise those technologies with the greatest potential environmental and economic benefits, using transparent criteria including the UK's potential as an **attractive location for development**, based on its policy environment, natural or geographical advantages, and technical and business skills and capabilities.

The Business Response

Business is ready to invest in the environment as never before. Driven by political developments, increased public consciousness and the emergence of consumer demand for environmentally responsible products and services, environmental concerns are poised to permeate the whole of the economy. They are already beginning to reshape business strategy and operations.

The policy response described above has the potential to accelerate this trend, prompting in turn a response from businesses, investors, employees and consumers.

- More **businesses** will invest in greener products and services meeting demonstrable needs.
- Competition to attract the best skilled **employees** for environmental markets will increase and good environmental performance will increasingly become part of creating an attractive job market.
- When the **investment** community sees an opportunity for profit they will demand action to improve companies' environmental performance.
- Over time, **consumers** will have greater confidence in green products and services and make business action more consumer-driven. As a result the demand/supply equation will become more self-sustaining.

Business

The environmental market place is huge, global and growing rapidly. In the UK, the environmental goods and services sector is estimated to have a turnover of £25 billion and to employ 400,000 people. Environmental services are an expanding market, and the UK is emerging as a world leader in related financial and business services, particularly in carbon markets.

But these impressive figures underestimate the impact of environmental markets, which increasingly pervade the whole economy. There are opportunities for all businesses in taking steps to improve both **operational performance** through greater 'eco-efficiency', and **sales performance** by offering goods and services that are more attractive because of an environmental edge. These include:

- addressing the environmental impacts of products throughout their whole life cycle;
- investigating the scope for 'closed-loop' production, where recycled materials become the feedstock for new products;
- re-engineering processes to cut costs and environmental impacts;
- re-designing goods, incorporating environmental factors from the start;
- reducing resource consumption by selling added-value services rather than more products.

Even when action to improve environmental performance would provide economic benefits to individual businesses, it is not always pursued. Government already provides support to business through bodies such as Envirowise and the Carbon Trust, but CEMEP believes a **longer-term, better-resourced system of business advice for resource efficiency** is needed, with a strong focus – supported by trade associations and other representative bodies – on perpetuating and spreading successful practices and on understanding the risk/reward drivers for taking up opportunities.

Supply chains can become more resource efficient by bringing together companies from different business sectors to trade and share materials, energy, water and other assets. This is known as 'industrial symbiosis'. To embed this approach more widely, Government and industry should improve the provision of **training and professional development** for supply chain management and public and private procurement professionals.

A key barrier to more effective supply chain management is lack of credible, comparable information about environmental impacts. Government, business and trade unions should tackle the proliferation of consumer-facing initiatives on labelling and certification by jointly developing, agreeing and adopting **standardised protocols** for measurement and reporting of carbon and other impacts.

Material resources will become increasingly important for businesses as disposal costs increase and scarcity becomes an issue in the face of huge demand in the emerging economies. A research effort is needed to understand how reliable an indicator the carbon footprint is for **resource use and environmental consequences** more broadly.

Employees

Future sustainable economic prosperity is a core interest of UK employees, as they are dependent on it. For the TUC, the key issue is securing a 'just transition' to a low-carbon economy for employees, protecting and promoting equality and social justice. All stakeholders have a responsibility to take this agenda forward.

Commissioners recommend that Government invite the new UK Commission for Employment & Skills to review the implications for **employment and skills** of the move to a sustainable economy, and consider whether

existing bodies are sufficient to identify where employment opportunities and skills needs are emerging in environmental markets. Surveys have shown that almost one in three environmental firms suffer from skills gaps.

Employees' enthusiasm to tackle climate change can be harnessed to help businesses reduce their carbon footprint. Trade Unions should continue to support environmental **workplace initiatives**.

Investors

The UK leads in Europe in the share and spread of venture capital for clean technology. Investors are showing strong interest in the opportunities, risks and liabilities created by environmental challenges, and increasingly agree that integrating economic, environmental and social success factors into business strategy can result in competitive advantage. To invest in environmental markets, investors need reliable information about companies' environmental impacts, and Government should consider integrating agreed standards of disclosure with corporate, pension fund and charity **reporting requirements**, and establishing **voluntary benchmarks**.

Consumers

The green consumer provides an incentive for some businesses to develop greener products and services and more environmentally responsible business practices. But businesses need to build more confidence in their green credentials and to make it easier for consumers to 'buy green' by providing options that have clear convenience and cost advantages at the same time as reduced environmental impacts.

Consumers need clear information and straightforward opportunities to engage with and better manage their electricity, gas and water use. '**Smart metering**' can provide this, but its widespread adoption requires policies that create a clear and credible market requirement against which businesses can invest in the product development that will bring down costs; in the water sector, for example, a commitment to the introduction of flexible tariffs would achieve this.

Implementation

In this Report, Commissioners make the case for additional policies to support innovation directly and for explicitly joining up innovation policies with environmental policies. They also highlight the need to find ways to value innovation properly in public finance. CEMEP recognises this cannot be achieved overnight. The agenda covers many Government Departments and agencies and valuing innovation is fraught with practical difficulties. **Capacity building** and training may be needed for officials.

However, CEMEP is also clear that making progress will depend on commitment from the highest levels in Government and clear **ownership** of this agenda. Government should consider whether existing structures and organisation can provide this.

Commissioners also recognise that all **stakeholders** have a role to play, and urge all to consider how they can contribute to the implementation of this Report.

List of Recommendations

1. Government should set credible, long-term environmental goals, consistent with business investment cycles. One means of achieving this is through building national consensus by opening decision making to wider society. 'Credible' and 'consensus' need not mean unambitious.

   Where a pressing environmental case can be made, goals should be set in areas other than climate change, such as products and materials. The newly established Products and Materials Unit within Defra should facilitate this.

2. Government, working with EU partners as necessary, should urgently consider options to reduce the uncertainty in carbon prices under the EU Emissions Trading Scheme, or at least its impact on business, and so increase the incentives to invest and innovate to cut carbon emissions.

3. Government should explore the scope for making greater use of progressively updated or 'dynamic' performance standards to drive improvements in the resource efficiency of products, particularly at the EU level.

4. Government should ensure that it sets out and adheres to well-defined timetables for the implementation of environmental legislation. Examples of where this would be relevant are implementation of the Energy Using Products (EuP) Directive, and the proposals in England's Waste Strategy 2007 to consider landfill bans for certain materials (should these be taken forward).

5. Government should commission a study of how the long-term needs and opportunities from innovation can be incorporated into cost-benefit analysis guidance, with a view to assessing longer-term impacts on economic performance routinely in environmental policy appraisal.

6. Government Departments' and regulatory agencies' science and innovation strategies should not focus only on the use of science to support policy, but should address their role in inducing and rewarding private sector innovation that furthers the Government's environmental objectives.

7. Government, business and the relevant bodies should review the product approvals regime in the construction sector to better understand the barriers to introducing innovative, sustainable products. Measures should be identified to overcome these barriers and, where appropriate, applied more widely.

8. Government should review the duties of the economic regulators in the energy and water sectors to give greater prominence to the importance of environmental innovation in meeting sustainability goals, and back this up with guidance as to how a more complex set of duties might be interpreted.

9. Government should facilitate the scaling-up and replication of the Forward Commitment Procurement (FCP) model in the public sector by:

   - identifying where better, more cost-effective solutions are needed to achieve environmental policy objectives;
   - developing the public sector's capability to engage effectively with the market using FCP, including by establishing a 'Challenge' scheme; and
   - adopting the FCP model for the 'Zero Waste Places' initiative.

10. Government should establish 'Environmental Innovation Zones' where local area partnerships are empowered to use a range of policy measures to bring forward innovative solutions to deliver unmet environmental goals. This should be

seen as the first in a series of progressive steps to transforming market sectors and creating economic opportunities on a wider scale. Successful examples should be replicated and participants encouraged to collaborate, where appropriate, to create economies of scale.

11. To improve the development and uptake of renewable and low-carbon energy technologies in the UK, Government should use targeted sectoral deployment support measures more widely, with careful attention to the choice of instrument for different stages of technology maturity.

12. To leverage best overall value for money from the funds available, existing capabilities and new initiatives in RD&D across the public sector and industry should be better coordinated. Synergies should be sought between different strands of innovation support, including linking RD&D support to procurement opportunities.

13. An 'Options Approach' should be taken to RD&D support, whereby:

- a diverse portfolio of emerging technologies is supported as consistently as possible beyond early-stage R&D and through the development lifecycle; but
- progress is reviewed at the end of each development stage, and support withdrawn for underperforming technologies.

14. Government should develop a strategic capability to prioritise its RD&D support for innovation in environmental markets, using transparent criteria to target those technologies with the greatest environmental and economic benefits.

15. To create market opportunities by improving the eco-efficiency of their operational performance and developing environmentally improved products and services, business should:

- address the whole life cycle of products, to enable all environmental impacts from 'cradle to grave' to be identified and reduced;
- investigate the scope for 'cradle to cradle' or 'closed-loop' production, where recycled materials become the feedstock for new products, and spreading new practices through the supply chain;
- assess how to re-engineer processes to cut costs while reducing pollution and resource consumption and avoiding environmental risk;
- investigate the scope for re-designing or re-manufacturing goods, incorporating environmental factors from the beginning of the design process; and
- consider how to create higher profits while reducing resource (including energy) consumption, by selling added-value services rather than more products.

16. Government should consider the need for a longer-term, better-resourced system to advise business on resource efficiency, with more emphasis on upstream measures and dissemination. This should inform the Government's ongoing Business Support Simplification Programme.

17. Government and industry should work together to improve the provision of training and professional development for supply chain management and public and private procurement professionals, to enable them to better manage the environmental implications of their supply chains.

18. Government, business, trade unions and other stakeholders should jointly develop, agree and adopt standardised protocols for measurement and reporting of carbon and other impacts, such as use of material resources and water. These should provide clear and simple, yet robust and credible, information to allow business and consumers to behave in a more resource-efficient way, and should be applied at intermediate stages as well as the end of supply chains.

19. Government, along with business, should sponsor a study of how reliable an indicator the carbon footprint is for resource use and environmental consequences more broadly, and which aspects it fails to reflect.

20. To better understand where employment opportunities and skills needs are emerging in environmental markets, all stakeholders have a responsibility and a role to play. Government should map the various fora where these issues are already under discussion to help identify whether existing bodies are sufficient to take the agenda forward.

Following the Energy White Paper request to Sector Skills Councils (SSCs) to report on skills gaps in the energy sector, Government should invite the UK Commission for Employment & Skills to review with SSCs the implications for employment and skills of the move to a sustainable, low-carbon and resource efficient economy, and to make recommendations to Government.

21. Trade Unions should continue to press for companies to commit to and work for socially and environmentally responsible values. They should provide the necessary support frameworks for their members to lead and participate in workplace initiatives (such as training on resource efficiency) that will generate environmental improvements and increased employee loyalty and satisfaction.

22. To facilitate investor scrutiny of environmental markets, Government should consider integrating agreed standards of disclosure into corporate reporting guidance, and should encourage the establishment of voluntary benchmarks and consistent methods for corporate, pension fund and charity environmental disclosure.

23. Policies on the introduction of smart metering should create a clear and credible market requirement against which business can invest in the cost-effective deployment of technology. In the water sector, for example, a clear commitment to the introduction of flexible tariffs would achieve this.

24. All interested parties, including Government, business, investors, employees and consumers, should consider how they can contribute to the implementation of CEMEP's recommendations.

This cross-cutting agenda must be driven forward across Government, and Government should consider whether existing structures and organisation can achieve this. It should also put in place capacity-building measures, such as training at the National School of Government, to increase awareness among officials of the links between environment, competitiveness and innovation.

Part 1: Analysis

1.1 Building on the Stern Review

The Stern Review of the Economics of Climate Change provides the starting point for CEMEP. Stern's main conclusions have been accepted by Government and its analysis is built on in the 2007 Energy White Paper.

Stern came to a simple conclusion: the benefits of strong and early action on climate change far outweigh the economic costs of not acting. It estimated that the overall costs and risks of climate change would be equivalent to losing at least 5 per cent of global GDP each year, now and forever. If a wider range of risks and impacts are taken into account, the estimates of damage could rise to 20 per cent of GDP or more.

In contrast, the costs of action – reducing greenhouse gas emissions to avoid the worst impacts of climate change – could be limited to around 1 per cent of global GDP each year. Stern acknowledges that the costs will be higher for some countries and some sectors, and that there may be some impacts on the competitiveness of a small number of internationally-traded products and processes, though these can be reduced or eliminated if countries or sectors act together. Nevertheless there will be a transition to be managed.

Like other environmental challenges, climate change involves market failures that require the effective intervention and attention of governments. According to Stern, policies to reduce environmental burdens should be based on three essential elements:

- putting a price on pollution, through taxes, trading or regulation;
- supporting the development of a range of cleaner, more productive technologies;
- removing barriers to the take-up of opportunities for improved environmental performance, including through behaviour change and investment decisions.

Stern went on to say that for the global economy as a whole, there will be benefits from innovation that will reduce and offset some of the costs. There will also be significant new opportunities across a wide range of industries and services, and individual companies and countries should position themselves to take advantage of these. CEMEP was established to consider and make recommendations on this issue.

The analysis and policy framework identified by Stern and developed in this Report is relevant to all environmental markets to a greater or lesser degree. While much of the current political focus is on climate change and low-carbon technologies, CEMEP has also considered other environmental challenges, including water supply and finite and non-renewable resource consumption.

1.2. Environmental Markets and Economic Performance

The transition to a low-carbon, resource-efficient economy will see the emergence of new technologies and innovations that will stimulate new business models, products and services, transform existing sectors of the economy and create entirely new industries.

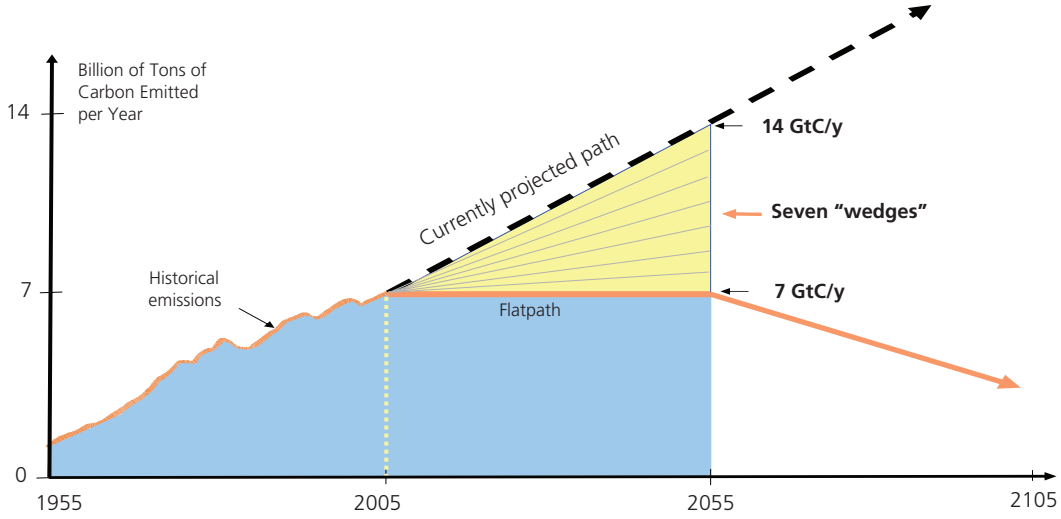
Changing markets

The traditional market for environmental goods and services comprises suppliers of pollution control, including waste management, water treatment and land remediation technologies, as well as energy management and renewable energy. The market is primarily driven by compliance and regulatory concerns. Though such a diverse sector is difficult to define and therefore quantify, it was estimated to be worth $548 billion worldwide in 2004, and forecast to grow to around $700 billion by 2010 – triple the size of the global aerospace industry.

The threat of global climate change and the urgent need to reduce emissions is fundamentally changing the nature of environmental markets. Innovation underpins any politically viable transformation to a sustainable and low-carbon economy: the alternative would be slower economic growth, including for example restrictions on consumer choice and travel. The innovation required can only be delivered through the investment and ingenuity of business, and the scale of the challenge means that policies to tackle climate change will need to have a large impact on global investment (box 1.1).

Box 1.1 Innovation and the investment challenge

The Princeton Wedges model below illustrates the scale of the investment required to reduce carbon emissions to safe levels, and the potential new business opportunities. To be successful, government policies to tackle environmental problems need to influence private sector investment decisions.



The Princeton Wedges concept identifies a number of different technologies, each of which could displace about 1 gigaton of carbon emissions per year by 2050. Seven of these wedges would be required to stabilise carbon emissions. While all are existing technologies, most are far from commercially competitive and would require huge scale-up to deliver the 1 gigaton reduction.

Some potential wedges

1. **Wind** – 300,000 5MW turbines that cover an area the size of Portugal.
2. **Solar** – 700 times current capacity, growing 60 times faster, and covering 10 million hectares.
3. **Biofuels** – 250 million hectares of crops, one sixth world crop production.
4. **Advanced vehicles** – 2 billion cars at 60mpg (lubes, hybrids, lightweight materials).
5. **Carbon sequestration** – Carbon capture and storage at 700, 1 GW coal power plants
6. **Hydrogen fuel** – 1 billion cars powered by carbon emission-free hydrogen
7. **Trees** – Decrease tropical deforestation to zero, and establish 300 million hectares of new tree plantations (twice the current rate)

[Source: *Pacala and Socolow (2004), Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies.* Science 305. no. 5686, pp. 968 – 972. *Figure from Carbon Mitigation Initiative* (http://www.princeton.edu/~cmi/)]

This will generate new opportunities for wealth and job creation, most notably where entirely new products and services are created. Business will need to innovate to transform the way energy and natural resources are used in production, just as mechanisation and specialisation once transformed the use of labour. There will be winners and losers: the products, services and competitiveness of many firms are likely to be challenged. Changes in lifestyles and consumer behaviour will emerge, making business action more intuitive and the demand/supply equation more self sustaining. The countries and businesses that are best prepared for this transformation will reap the economic benefits.

Emerging opportunities

A recent estimate puts the current market for new low-carbon energy technologies at around $100 billion per year, having grown by 43 per cent over the previous year. This already large emerging market could become huge if there is concerted international effort to address climate change. Stern estimated that it would be worth at least $500 billion per year by 2050, while others suggest that the overall added value in the low carbon energy industry could be as high as $3 trillion per year worldwide by this time[1]; and could employ more than 25 million people. These projections become even larger when energy applications in transport and buildings are included. In transport, for example, there will be markets for new vehicle technologies based on efficient designs such as the hybrid engine, and vehicles capable of using second generation biofuels and hydrogen.

But this still underestimates the size of the opportunities. Low-carbon and cleaner technologies are beginning to be embedded in process and product development as mainstream businesses make explicit commitments to deliver products and services with lower environmental impacts. Attention is being paid to improving resource productivity, which can reduce the carbon embedded in products as well as the unsustainable consumption of natural resources (box 1.2). This in turn is having impacts throughout the supply chains and increasing consumer and employee awareness.

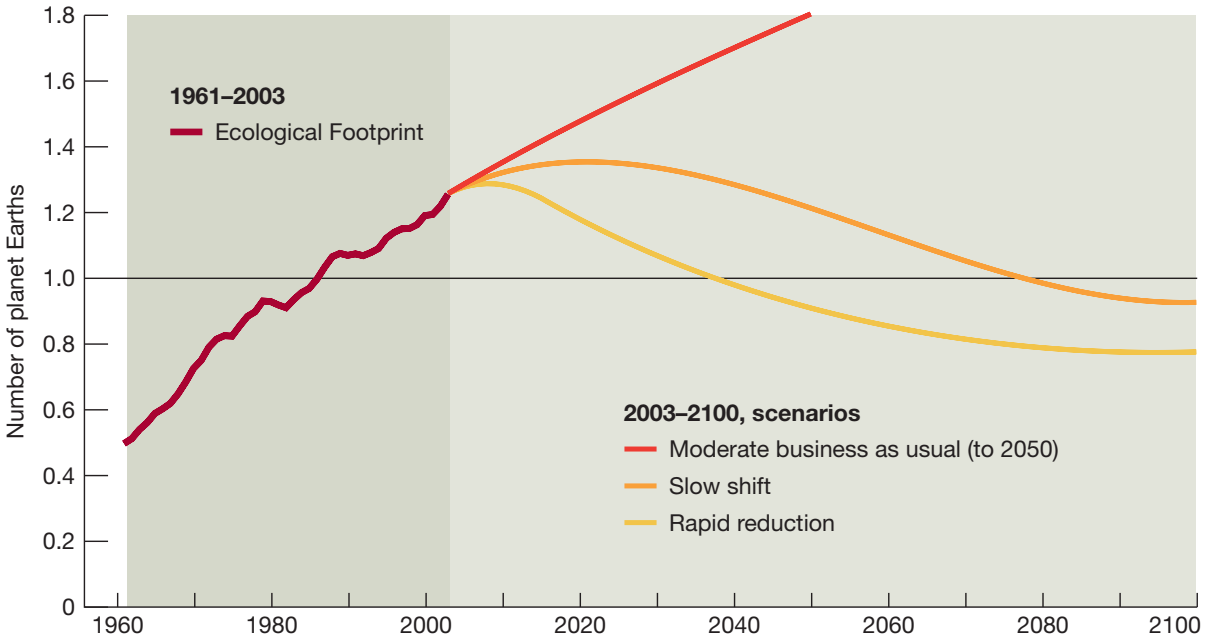
New opportunities have emerged for business services and financial markets. For example, the City of London's world-leading expertise has been quick to create new financial institutions to help deploy capital effectively in reducing carbon emissions. Creating markets in water and resource efficiency could lead to similar new business opportunities in these areas, such as brokering and service companies that are rewarded for reducing resource use in their clients. There will also be significant opportunities in mitigation of and adaptation to the impacts of global climate change, for example in the water sector.

[1] Calculation by Professor Dennis Anderson, Imperial College London, based on the estimate that, by 2050, 70 per cent of expenditure that would have been directed to fossil fuels in the absence of carbon abatement will be directed to low carbon technologies. Using the expected value of world product by 2050 and the proportion of world product currently represented by fossil fuels gives a figure of $3 trillion. Such estimates are, of course, approximate, but provide a good indication of the likely size of the market for low carbon technologies.

Box 1.2: Managing unsustainable consumption

Measurement of the world's ecological footprint by WWF suggests that, since the late 1980s, global demand for natural resources has exceeded the Earth's regenerative capacity. Forecasts of future growth under a business as usual scenario predict that, by mid-century, humanity's demand on nature will be twice the biosphere's productive capacity (see below).

To reverse this trend by 2050, the 'Rapid Reduction' scenario assumes a massive step change in 'cleantech' deployment, 50 per cent cuts to carbon emissions, and radically different business models. While there are no comprehensive estimates of the scale of investment required, it is clear that significant technological advances will be needed to be able to offset the impact of demand growth.



[Source: *adapted from WWF Living Planet Report 2006 © WWF (panda.org). Some rights reserved*]

Potential areas of future UK comparative advantage

As most environmental markets are starting from a low base and currently amount to only a small fraction of their future potential size, it is still possible for countries to be a 'late starter' and gain a foothold in virtually any area.

In the short term, it is likely that the UK will become increasingly specialised in areas of current strength and, based on the country's overall economic strengths, these are likely to include service industries as well as the manufacturing sector. Natural advantages such as globally exceptional offshore wind, tide and wave resources may also suggest areas of future comparative advantage for the UK.

Bodies such as Carbon Trust and the Technology Strategy Board have identified those sectors or technologies where the UK has comparative advantage in environmental markets, by conducting assessments of key research capabilities, business strengths, environmental benefits and market potential (box 1.3). Opportunities for UK business from environmental markets are discussed in more detail in Part 3 of this Report.

1.3 Capturing Economic Benefits for the UK

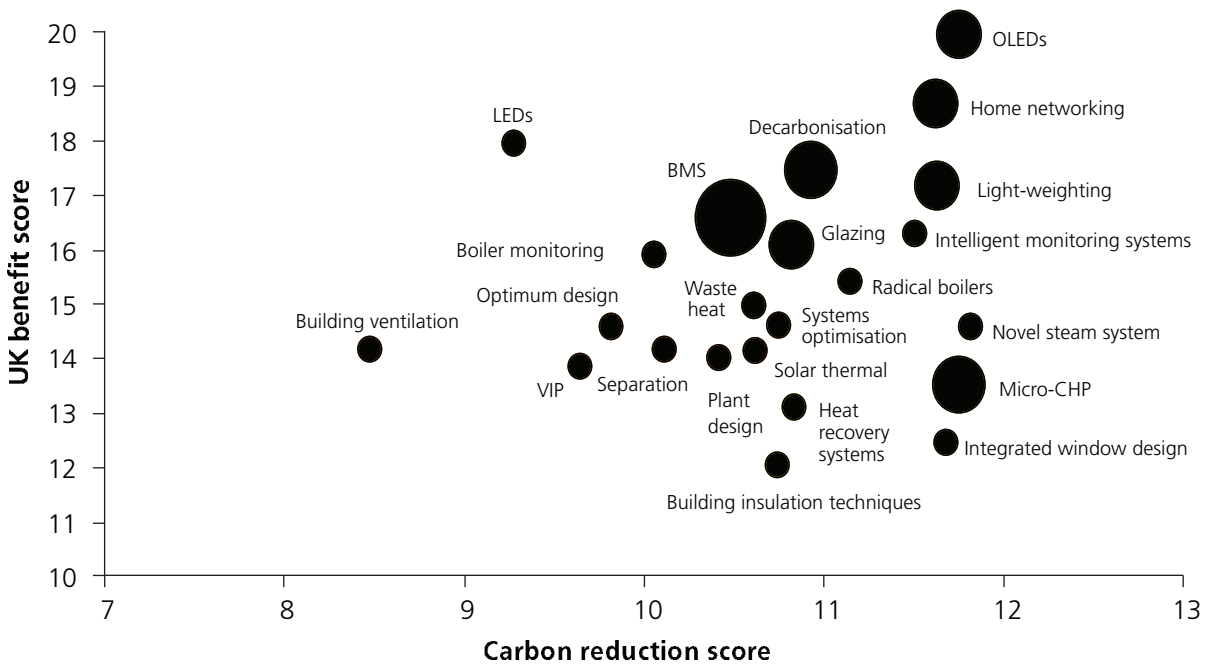
CEMEP's task has been to consider how the more stringent environmental policies that will be needed in future to combat climate change and tackle other environmental impacts can be implemented with a positive impact (or at least the minimum negative impact) on the overall performance of the UK economy. This can be achieved by:

- minimising the cost of achieving environmental goals; and
- maximising the opportunities for wealth and job creation to offset costs.

The first of these approaches is generally framed by short-term cost-benefit considerations and is well established in policy making. The second needs to consider longer-term impacts on the economy, including stimulating investment in innovation. There may

Box 1.3: Assessment of UK comparative advantage

Energy Efficiency Technologies

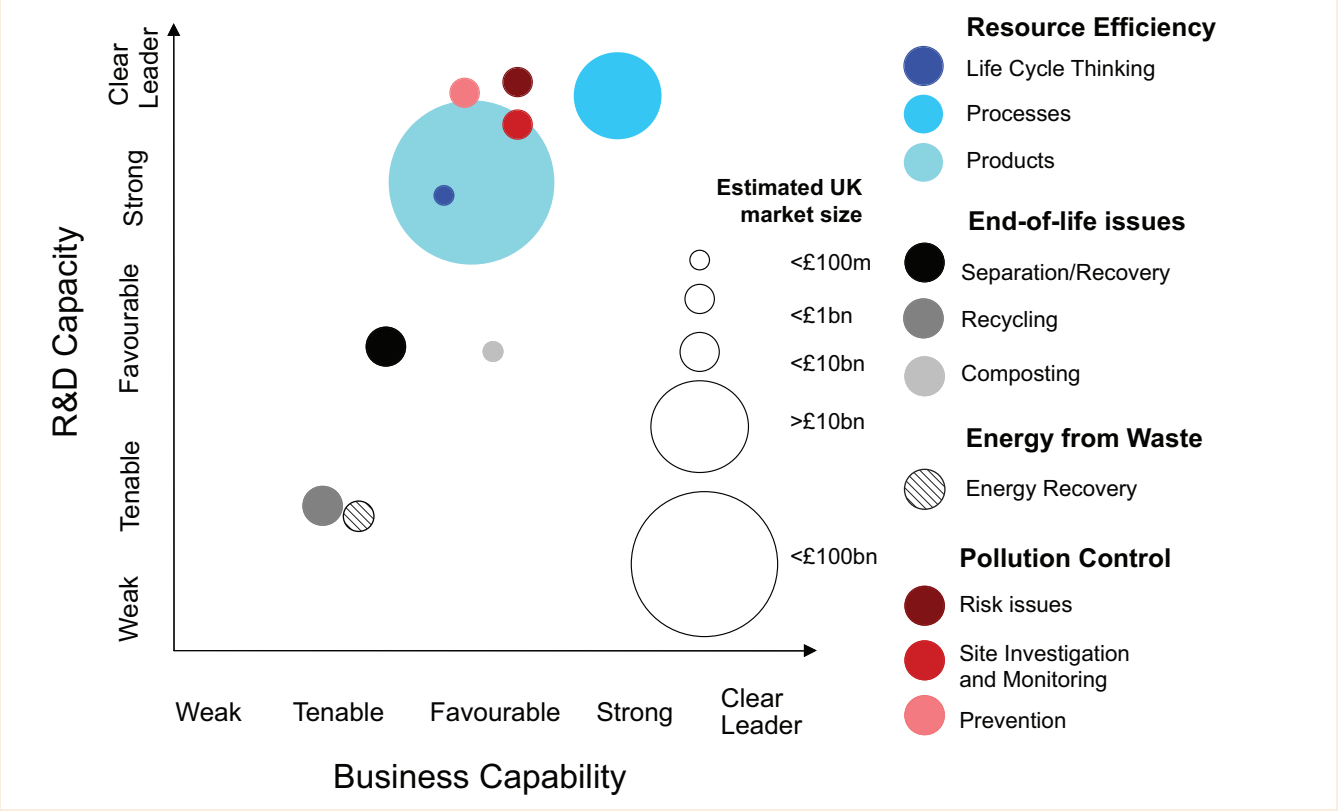


[Source: *Energy Efficiency Innovation Review*, HM Treasury, Defra, Carbon Trust, Energy Saving Trust (2005) and *Assessment of Emerging Innovative Energy Efficient Technologies as part of the Energy Efficiency Innovation Review*, Future Energy Solutions for Defra (2005)]

Rating of non-commercial energy-efficiency technologies by potential for carbon reduction and UK economic benefit. The study scored each technology on the basis of cost-effectiveness of carbon reduction benefit (x-axis) and potential economic benefit to the UK (y-axis). Economic benefit was defined as where RD&D could return a commercial value to the UK, and included an assessment of UK capability to develop and market the technology. Scores were based on expert opinion, supplemented with available data on energy use, market research etc.. The size of the co-ordinate indicates the calculated total potential carbon reduction associated with each technology (regardless of cost effectiveness or economic benefit).

Box 1.3 *(continued)*: Assessment of UK comparative advantage

Sustainable Production and Consumption Technologies



[Source: *Technology Strategy Key Technology Area: Sustainable Production and Consumption,* DTI (2006)]

UK capacity to develop and exploit technologies and services in sustainable production and consumption, assessed qualitatively by consultation. Area of circle indicates estimated market size.

be tensions and trade-offs between the two approaches. One of CEMEP's goals has been to work towards a framework which takes into account both perspectives.

Free riders and first movers

Tackling climate change and other environmental challenges raises the problem of the provision of the general public good. If the short-run costs are perceived to exceed any longer-term benefits accruing to individual countries, they have an incentive to 'free ride' and wait until other countries have incurred the costs of developing new environmental technologies.

Concerns about 'free-riders' should not be overestimated: most developed and some developing countries already offer support for the development and deployment of low-carbon technologies. In addition, it can be argued that some environmental problems, such as climate change, are so serious that a more active approach can be justified, particularly for developed countries such as the UK who can only influence other countries to take action if they do so themselves. Furthermore, there may be economic benefits to taking a lead in the development and adoption of innovations to tackle environmental problems, including by exploiting 'first mover' advantage (box 1.4).

Box 1.4: 'First mover' advantage – Danish wind power

The Danish wind power industry is often cited as an example of first mover advantage in environmental markets. It is now Denmark's third largest exporter with 38.5 per cent of the global market for wind turbines; and has generated €4 billion of economic activity; and created 20,000 jobs.

However, some argue that, whenever a market arises because of government intervention, distortions and inefficiencies inevitably result. They point out that, after taking account of the subsidies and tax incentives provided by Danish taxpayers, cost-benefit analysis has shown a net economic loss of €400 million (although this takes no account of environmental gains).

It is very difficult at this time to prove net benefit and whether or not the Danish economy as a whole is better off from its wind power industry. What is clear, though, is that, through investment in R&D and market deployment support, technological advances have produced profitable technology, and the future export potential of wind turbines could help offset the Danish Government's initial investment.

On the other hand, it is difficult to predict where future strengths might lie and governments are not generally good at 'picking winners'. Moreover, in a globalised economy there is no guarantee that the longer-term economic benefits that might offset short-run costs will be captured by the 'first mover' economies.

Nonetheless, suppliers and manufacturers are more likely to invest in those countries that provide the most supportive business environments. It follows that if the UK wants to be a global leader in environmental markets it will need to provide a more coherent and supportive policy framework than its competitors.

A policy framework to attract investment to the UK

By becoming one of the best locations in the world to develop and introduce low-carbon products and services, the UK can attract the investment that will lead to growth and jobs in the future. OECD work[2] on environmental markets suggests that, while basic research is still mainly done at headquarters, development activities are increasingly being outsourced to bring them closer to new markets and tap knowledge sources abroad.

Commissioners are not concerned for the purposes of this Report whether a company is also operating and investing globally, or whether it is UK- or foreign-owned: the key is whether it is active and creating wealth in the UK. This is easily understood by considering the City of London. That London is such an important financial centre is of considerable benefit to the UK. However, it does not matter that most of the companies are non-British: the important fact is that they have chosen London as a major operating location. And its attractiveness today as an international location to do business stems from its favourable regulatory environment.

CEMEP believes the policy goal should be to make the UK an internationally attractive location to invest and do business in environmental markets. To achieve this, policy interventions should be structured in ways that go with the grain of market forces, focus on market failure, and avoid unnecessary subsidies or picking winners. The skills and knowledge spin-offs provided by the UK becoming a centre for environmental markets will naturally favour the creation and growth of UK-based companies in the future.

[2] *Environmental Innovation and Global Markets*, OECD (unpublished, report in preparation)

The EU and International Dimension

The UK will need to act decisively and independently to exploit the opportunities associated with meeting environmental challenges. But in many areas the UK cannot and should not proceed unilaterally, and will need to act alongside the European Union and other international partners. Policy making at this level, and the development of multilateral policy frameworks, helps to reduce concerns about impacts on national competitiveness, and increases the scale and attractiveness of the market opportunities created.

A leadership position on climate change and other issues presents the UK with the opportunity to shape and influence EU and wider international developments. The UK should press for the approach set out in this Report to be used in wider international fora. At the EU level specifically, elements of the approach should include:

- Working to ensure that the costs of environmental externalities are fully reflected in all EU policies so that consistent long-term price signals are sent across European markets. Getting the EU Emissions Trading Scheme working effectively is a priority in this respect.
- Helping the EU to develop its own strategy for environmental markets and economic performance as part of the Lisbon Agenda for growth and jobs, for example through the Commission's proposed 2008 Action Plans on Sustainable Industrial Policy and Sustainable Consumption and Production. Opportunities to create globally leading markets in Europe should be exploited while ensuring that no unnecessary subsidies are established.

1.4 A framework for effective policy intervention

Market failure provides the framework for thinking about effective policy intervention. Environmental innovation is subject to two distinct market failures: pollution represents an under- or zero-priced negative externality, and new technology generates positive externalities which are sometimes difficult to value. Hence environmental innovation is doubly under-provided by markets.

The need for both environmental and innovation policies to address these market failures is accepted. There are, however, disagreements on the best ways to encourage environmental innovation. These stem from polarised views about the nature of the innovation process itself, including the role of supply 'push' and market 'pull' measures and whether environmental innovation is different from innovation in general. These different perspectives, which have significant and diverging implications for policy interventions, are discussed in this section.

Environmental policy

The pollution externality stems from the fact that environmental costs are only partially accounted for in the market system and in prices. It is through environmental policy that this market failure can be corrected and the externality internalised.

There is much debate about which environmental policy approaches best induce innovation, including within CEMEP. Proponents of the 'classical' economic response believe innovation responds most efficiently to market incentives, so that putting a price on environmental impacts through taxation or cap and trade schemes is the best way to induce environmental innovation. Others, particularly

advocates of the Porter Hypothesis[3], favour the use of demanding, outcome-based direct regulation in addition to pricing.

Whichever approach is used, there is no significant disagreement that flexible, market-based policy regimes provide greater incentives to innovate than prescriptive regulations, nor that much current environmental regulation is not as flexible or market-based as it could be. In CEMEP's view there will be economic benefits in making environmental policy more flexible and market-based whether the end point is truly 'win-win' or merely meeting the same environmental objectives at lower cost.

Innovation policy

The 'classical' economic response complements the full pricing of environmental externalities with generic innovation support including publicly funded R&D and intellectual property protection to ensure that innovators appropriate the benefits of their efforts. For many sectors of the economy, public policy of this kind will be adequate. The case for additional support for environmental innovation needs to be justified.

Stern concluded that environmental policy alone would be insufficient to achieve the rapid progress that climate change in particular requires. The optimal set of policies will also include instruments designed explicitly to increase innovation, as distinct from environmental policies that induce and/or stimulate innovation, as a side-effect of internalising the environmental externality.

Commissioners agree that setting a price high enough to create the conditions for business investment in environmental innovation is politically difficult. In addition, particularly for market-based approaches like the EU Emissions Trading Scheme for carbon, the pricing instrument may not operate on a sufficient timeframe or with enough certainty to generate a stable enough price for businesses to attribute full value to environmental innovation. As high and stable prices are difficult to achieve in practice, pricing mechanisms should be supplemented by additional direct support for environmental innovation.

There is wide, but not universal, agreement within CEMEP that there is a case for additional policies to support innovation directly, even disregarding the difficulties in establishing an optimum price for environmental impacts. There is value attached to creating technological options in the face of uncertainty over the impacts of environmental damage (such as climate change) and over the future costs of technologies. It will be cheaper than relying on price alone to promote the development of environmentally improved options directly where it is known that there are barriers to their development. This is because, in the absence of genuinely viable alternatives to incumbent technologies (as is the case, for example, for fossil fuel-derived transport fuel or electricity) the response to price signals is muted. Once cost-effective options are available, elasticities will rise and price signals will work better.

Environmental innovation

Environmental innovation has specific characteristics that require additional support.

First, the demand for environmental goods and services is defined primarily by government policy. Companies inevitably attach a degree of political and regulatory risk to future environmental markets. Governments can help to manage this through judicious choice of environmental policy tools, but an element of such risk will remain unavoidable.

Second, the products of environmentally improved processes (a kilowatt hour of

[3] The Porter Hypothesis holds that environmental regulation of the right sort can stimulate innovation that will (at least in part) offset the cost of compliance, and may create a 'win-win' whereby economic benefits outweigh the costs.

renewable electricity, for example) are seldom differentiated from those of existing processes. This limits the gains from innovation to the pure cost savings after environmental externalities have been taken into account. This is compounded by the incomplete and underdeveloped methods currently available to value many such externalities.

Finally, the costs of environmental innovation are heavily associated with the demonstration/ early deployment stages of the innovation chain where political risk plays a particularly strong role.

These specific characteristics help to explain the investment gap (sometimes called the 'valley of death') at a key stage in the environmental innovation process where the costs of development and demonstration are highest and where political and regulatory risk create uncertainty about the benefits that will accrue to innovators.

Additional measures are required to narrow this gap, the most important being policy-led market 'pull' instruments that support the deployment of emerging environmental innovations by creating a 'lead market' for them.

Innovations commercialise first in lead markets; without them there can be no learning and no economies of scale or network effects. In consumer markets, this process is driven by product differentiation, meaning that some consumers are willing to pay a premium for a new product. In the environmental field, lead markets generally do not exist in the absence of policy intervention. These are discussed in more detail in section 2.2 of this Report.

From this analysis, CEMEP concludes that an optimum policy framework to minimise the costs of achieving environmental goals and maximise the opportunities for wealth and job creation should use the standard environmental policy instruments (putting a cost on environmental impacts, flexible market-based environmental regulation and removal of barriers) along with R&D support and intellectual property protection, but in addition explicitly support the deployment of environmental innovations through the use of market pull measures.

Market pull measures can help to reduce uncertainties and create options and, therefore, lower the long-term costs of substituting less environmentally damaging alternatives. Wherever possible, they should avoid 'picking winners' by focusing on desired outcomes instead of particular solutions.

2.1 Environmental Policy

Environmental policy is the critical factor in influencing investment decisions in environmental markets. It creates the long-term value for environmental goods and services by internalising the environmental harm caused by existing products and services, and stimulates the search for cheaper or better alternatives.

Long, loud and legal policy framework

Environmental markets are subject to political and regulatory risk, which business finds hard to manage. Such risk is not unique to environmental markets – all sectors of the economy face it. But the political risks for environmental markets concern uncertainties about whether and how governments will make policies that will create and shape a market that might otherwise not exist at all.

Risk can be reduced and some market failures overcome by creating a robust, long-term framework that gives business the time and confidence to invest in finding new solutions to environmental goals. Industry groups have characterised such a policy framework as 'long, loud and legal':

- Long: policy signals need to apply over a timescale that counts – not too short or too long.
- Loud: policies need to be clear and unambiguous and give confidence that the policy direction will be maintained.
- Legal: policies only give clear signals if they are credible, which generally means legal, enforceable and seen as likely to meet their objectives.

The Corporate Leaders Group on Climate Change has put it another way: to stimulate private sector investment a strong policy framework is needed that creates a long-term value for carbon emission reductions and consistently supports and incentivises the development of new technologies (box 2.1).

Implementing such a policy framework means applying the following principles to the practice of environmental policy making, which form the main focus of this chapter:

- Setting credible goals and targets that give business clear signals about the future direction of environmental policies.
- Harnessing market mechanisms, including getting the price signals right to give business the flexibility to achieve environmental objectives in the most cost-effective ways.
- Avoiding prescribing particular solutions to achieve the desired outcome, and allowing for the development of innovative, new solutions in policy formation and appraisal.
- Establishing a 'level playing field' through the removal of regulatory and institutional barriers that generally favour incumbent technologies.

Box 2.1: Corporate Leaders Group on Climate Change

The Corporate Leaders Group on Climate Change comprises major UK and international companies, including ABN Amro, Centrica, Shell, Tesco and Vodaphone. Specific measures identified by the Group include:

- Creating greater certainty about the long-term value of emissions reductions, and stimulating long-term investments by setting targets now for the year 2025.
- Providing incentives and support for investment in low-carbon technologies over and above that provided by the emissions trading market, including, in addition to a stable Renewables Obligation, other policies to create secure forward markets for new technologies that can then be deployed by a buoyant carbon market.
- Eliminating the policy inconsistencies and perverse incentives that undermine the effectiveness of climate policy, including by assessing the impact on carbon emissions of all new legislation and regulation.
- Using Government procurement policies to stimulate markets for new and existing low-carbon technologies, for example by developing emissions standards that could be used by Government and also adopted voluntarily by the private sector.

2.1.1 Setting Credible Goals

Setting credible environmental goals or targets on the basis of environmental need is an essential first step in reducing investor risk.

Goals can help provide investors with clear signals on the direction of policy. To be effective they need to be credible, unambiguous and set over a long enough timescale to influence investment decisions. The constant revision of policy can mean white papers, strategies and manifesto commitments are heavily discounted by business and investors.

To be credible goals therefore require careful specification and protection against revision, and these together make the task difficult. The available scientific evidence is likely to be open to different interpretations and, as discussed below, the assessment of costs and benefits will be subject to uncertainties. There will be opportunity costs to business and the wider economy if the priorities or forecast levels of improvement prove to be wrong.

Moreover, there are political risks in failing to achieve targets, so governments tend either to set goals that are easy to achieve, or to avoid setting them altogether. Either way, little influence on investment decisions results.

The credibility of goals can also be undermined by inconsistencies with other policies, such as the planning system, where objections and long delays to renewable energy projects like onshore wind farms work against targets on renewables.

One area where Government is making progress is climate change. Although the credibility of the initial commitment in the 2003 Energy White Paper to a 60 per cent reduction in UK carbon emissions by 2050 has been questioned, the measures put forward in the Draft Climate Change Bill go some way to giving this target the necessary credibility by:

- making it, and a 26 to 32 per cent reduction by 2020, legally binding;

- putting in place a new system of legally-binding five-year 'carbon budgets', set at least 15 years ahead; and
- establishing a new statutory body, the Committee on Climate Change, to provide independent expert advice, guidance and challenge to Government on achieving its targets.

Although setting goals is first and foremost the job of Government, CEMEP believes that opening up the decision-making process to a wider group of stakeholders in order to build a durable national consensus on environmental goals might be one way of giving them greater credibility and protection against revision. This would remove some of the political risk from Government, and should make the resulting goals both less prone to revision and, through the involvement of business, more consistent with investment decisions. 'Credible' and 'consensus' need not mean unambitious.

This effort should extend to areas other than climate change. Commissioners propose that policy on material resources would benefit from a clear long-term direction. A Products and Materials Strategy, developed in conjunction with stakeholders and setting out consensus-based targets for resource efficiency, should be an early objective for the newly established Products and Materials Unit within Defra.

Recommendation 1

Government should set credible, long-term environmental goals, consistent with business investment cycles. One means of achieving this is through building national consensus by opening decision making to wider society. 'Credible' and 'consensus' need not mean unambitious.

Where a pressing environmental case can be made, goals should be set in areas other than climate change, such as products and materials. The newly established Products and Materials Unit within Defra should facilitate this.

2.1.2 Market-Based Instruments

Measures to price environmental externalities are the most economically efficient policy response to environmental problems. By finding a way to convert credible long-term goals into effective long-term price signals, Government can make them meaningful to business and influence long-term investment decisions.

Environmental taxes and 'cap and trade'

The use of taxes to set long-term prices for environmental impacts has the advantage of giving companies a fixed price that can be built into investment plans. This works particularly well when future increases are signalled in advance, as with the escalator in the Landfill Tax. However, in some instances, taxation levels would have to be set very high to have a significant effect on their own.

As an alternative to taxation, 'cap and trade' systems set an overall binding limit or cap, which is translated into a cap on individual businesses. Trading allows companies to meet their cap at optimal levels either by reducing their own emissions or by buying permits from other businesses who can make reductions more cheaply. In this way, cap and trade schemes provide incentives for investment in cleaner technologies and processes at lowest cost, particularly when the overall cap is progressively reduced with time.

Taxation provides certainty over future price, but leaves the environmental outcome uncertain, whereas a cap and trade system provides certainty over future emissions, but allows prices to fluctuate. CEMEP Members see advantages to both approaches but, in practice, cap and trade schemes tend to be favoured by business and governments and have become accepted as the instrument of choice, for carbon at least.

Cap and trade is especially suited to dealing with problems such as climate change where the impacts are caused by aggregation of widespread or global emissions. However, it is not appropriate for all environmental impacts, particularly those that are felt locally or are accumulative, like land contamination or the production of dioxins. Furthermore, in some parts of the economy, cap and trade may not be viable due to high transaction costs, for example from the measurement and verification of individual emissions.

Uncertainty in the EU carbon market

The European Union's Emissions Trading Scheme (EU ETS) is the principal means of establishing a price for carbon for businesses in Europe. To date, it has been successful in delivering some changes in operating behaviour and a limited degree of investment to reduce carbon emissions. However, the price the scheme established has been subject to significant uncertainty. The reasons for this are two-fold:

- excess price volatility at certain points, due to the arbitrary or uncoordinated release of sensitive market data, or low liquidity in the market leading to certain transactions having a disproportionate impact on the carbon price;
- the collapse in the carbon price during Phase 1, as caps were not initially set stringently enough to ensure scarcity in the market.

Uncertainty about the future cost of carbon emissions under the EU ETS has reduced the impetus for businesses to invest in measures to cut them and the incentive to innovate to meet this need. CEMEP Members recommend that Government take steps to tackle this uncertainty, or its effect on business. CEMEP has explored two main approaches to doing this. First, by making improvements to the operation of the scheme and ensuring that caps are set appropriately, the market will work more as intended and a higher and more stable price should result. Second, additional mechanisms can be used to guarantee a minimum cost of emitting carbon. CEMEP Members recognise differences in opinion as to whether or not the second approach is needed in addition to the first, to give business the confidence to invest now in sectors where the price is set by the EU ETS.

Each approach is discussed in more detail below; CEMEP does not wish to recommend either one over the other, but recommends that Government consider the options carefully.

Improving the operation of the EU ETS

Establishing a new carbon market from scratch can present specific difficulties. The low and volatile carbon price observed under Phase 1 of the EU ETS is not necessarily representative of the future long-term behaviour of the scheme, and could be reduced by changing the way in which the market operates. Ensuring that caps for future phases are stringent enough in the context of overall EU emissions, and establishing more commonly agreed and transparent methodologies for setting national allocations will help to resolve the problem of a lack of scarcity in the market. There is evidence this is already starting to happen. Better 'policing' by the European Commission of the national allocations for Phase 2 has led to the EU cap for Phase 2 being set at 6.5 per cent below the emission outturn for 2005, with the forward price for Phase 2 increasing in response.

Better regulation and procedures governing the way in which market sensitive information is

released by the European Commission or Member States should help to dampen price fluctuations, which should also be reduced as the volume of trade increases and market participants become more experienced and confident.

One widely discussed approach to increasing certainty is to seek a longer commitment period for Phase 3 of the ETS, such as eight or ten years. Such an extension should be considered, but CEMEP notes that it may still be too short to boost investment significantly, and risks locking in a potentially inadequate EU political deal for an extensive period and possibly undermining the EU's international negotiating capital. A more effective and flexible alternative might be to adopt the approach proposed for carbon budgets in the UK Climate Change Bill, of setting caps more than one phase ahead of the current one.

Using guarantees to create credible expectations around price

The fundamental issue here is who should bear what kind of risk. Some degree of price fluctuation is natural in any commodity market. But for a commodity such as carbon reduction, that is entirely politically constructed (by the EU), expecting industry to bear all the risk around future commitments may not bring forth the investment sought. Those CEMEP Members who advocate a price guarantee believe that, if governments really want extensive private sector investment in the low-carbon sector, they need to reduce the risk associated with the price.

During the early stages of development of carbon markets, it may be appropriate to guarantee a minimum price. This could be achieved either through further changes to the EU ETS, or through separate, Member State-led, systems.

Under the EU ETS option, the EU would declare a minimum price target several commitment periods ahead, giving it credibility by setting it as a reserve price on auctions of allowances. Alternatively, more stringent national allocations could be made as described above, but in a way that explicitly links these to a given minimum price, specified as part of the European Commission's approval process.

The Member State-led option would entail providing operators in the UK, for example, with a guarantee that the future cost of emitting carbon will not fall below a pre-determined level. This could be implemented through:

- a scheme whereby HM Treasury levies a retrospective tax if the EU ETS price in the previous year was below the specified level;
- a carbon tax that fixes a minimum carbon price, which companies can offset against purchase of carbon allowances, to avoid double charging;
- a scheme in which HM Treasury enters into contracts with individual investors; there are several variants on this including the basic 'carbon contracts' idea and the proposal for electricity-specific contracts on the prices to be paid to zero-carbon power sources.

Recommendation 2

Government, working with EU partners as necessary, should urgently consider options to reduce the uncertainty in carbon prices under the EU Emissions Trading Scheme, or at least its impact on business, and so increase the incentives to invest and innovate to cut carbon emissions.

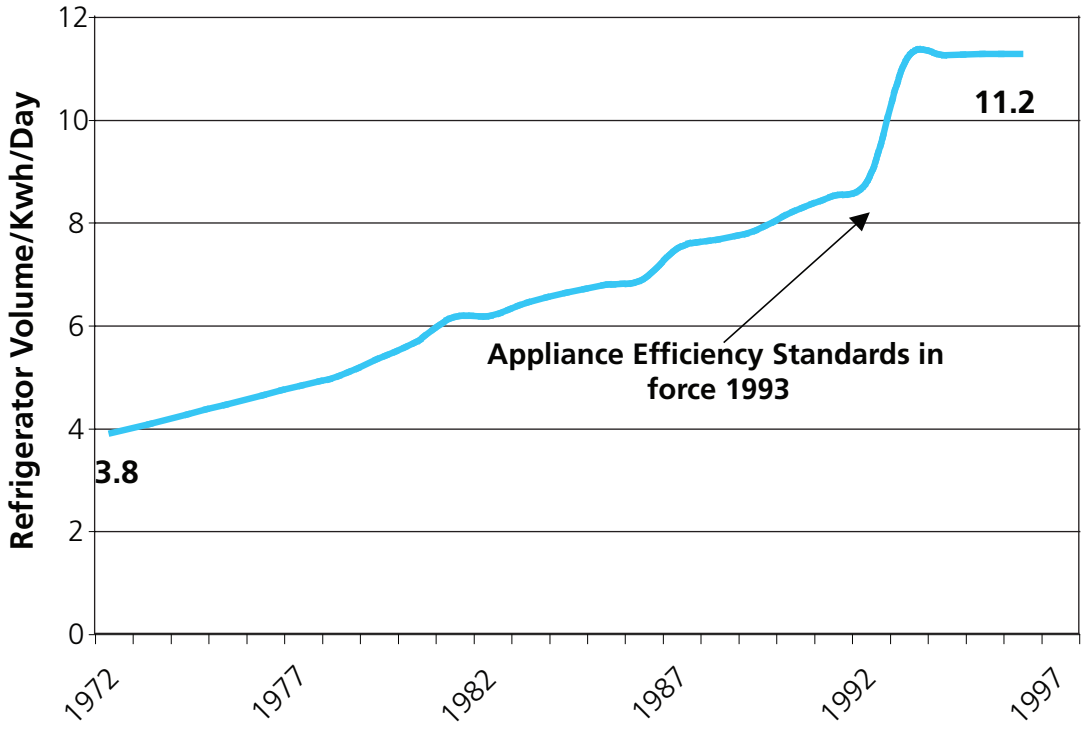
2.1.3 Regulation

Direct environmental regulation, such as targets, standards and quotas, can be inflexible, increase business costs unnecessarily through 'gold plating' and have unintended consequences. The definition of waste under EU Directives is a clear example of a regulation drafted with the best of intentions, but which has stifled innovation and delayed investment[4]. Nonetheless, well-designed direct regulation can be an effective way to supplement market-based instruments, and in some cases can stimulate innovation.

Dynamic performance standards

Some market participants will react only weakly to environmental price signals. For example, polluting activity may represent only a small fraction of a business's overall costs or of the cost of its product. In these cases, regulation can deliver environmental benefits quickly and, provided they are introduced with sufficient lead times, cost-effectively (box 2.2).

Box 2.2: Direct regulation and the energy efficiency of refrigerators in the US



The graph shows improvements in the efficiency of refrigerators in the US between the early 1970s and late 1990s. Energy efficiency (expressed as the refrigerator volume cooled by a unit of electricity) increased steadily over the years. During this time electricity prices fluctuated widely, without any significant effect on the rate of improvement in energy efficiency. However, the major feature of the graph is the steep rise in efficiency after the introduction of minimum efficiency standards in 1993, which shows that the regulation was able to realise a large untapped improvement in efficiency, in the absence of an effective price stimulus. The graph also demonstrates the danger and disadvantage of static minimum standards, when the rate of improvement declines to zero after the standard has been achieved. Regularly updating standards avoids this trap.

[Source: *US Energy Information Administration, www.eia.doe.gov*]

[4] *Environmental Innovation: Bridging the gap between environmental necessity and economic opportunity. First report of EIAG*, Department for Trade and Industry (2006)

Many existing regulations, however, simply enforce minimum standards or specify best available technology. These lock in existing technologies and provide no incentive to drive further improvements in performance. This can be overcome by making performance standards 'dynamic': deliberately setting them just beyond the current best technology on the market, and progressively updating them as performance improves. Such dynamic performance standards (and the timescale associated with them) must be fixed carefully so that the prospect of innovation to meet the target is urgent, but feasible. They must be outcome-based and not prescriptive. The Top Runner Programme in Japan (box 2.3) is a good example of such an approach.

Dynamic performance standards can be an effective tool in some areas, particularly product policy. CEMEP believes Government should explore the scope for its use in suitable product areas. For both legal and competitiveness reasons, product policy is often best pursued at European level. CEMEP notes the European Commission's interest in the Top Runner approach[5], and recommends that the UK support further analysis of how this could be best applied in an EU context. The forthcoming implementation of the 2005 Eco-Design for Energy Using Products (EuP) Directive provides a further opportunity to incorporate dynamic performance standards, drawing on the Top Runner model. The Directive embraces a range of environmental impacts of products beyond energy use, and standards should cover multiple resource efficiency goals.

Recommendation 3

Government should explore the scope for making greater use of progressively updated or 'dynamic' performance standards to drive improvements in the resource efficiency of products, particularly at the EU level.

Box 2.3: Top Runner Programme in Japan

Japan's Top Runner Programme sets energy efficiency standards across 20 product categories, including passenger cars, commercial vehicles and domestic appliances. Rather than using minimum performance standards, the Programme sets forward mandatory targets – usually six to ten years ahead – at a stricter level than the most energy-efficient product currently available in the market, taking account of the potential for future innovation.

Targets are set in close consultation with industry. They must be met by each manufacturer, rather than on average over the whole industry. Manufacturers have to provide information on whether their products have achieved the standard, at the point of sale. Enforcement is based on naming and shaming.

Meeting Top Runner standards is now a product design criterion for many Japanese manufacturers, and has become an aspect of competition, with companies racing to meet the standards ahead of each other.

Partly as a result of the Top Runner Programme, the Japanese vehicle fleet is the most efficient in the world, with an average mileage double that of the US. At the same time, Japanese car manufacturers are performing well by sectoral standards and are leaders in hybrid and other technologies.

[5] *Report of the Environmental Technologies Action Plan (2005-2006)*, European Commission (2007); COM(2007) 162 final

Innovation-forcing regulation

Innovation-forcing regulation, whereby a target is set significantly beyond what is currently achievable in order to stimulate innovation to reach it, is rarely used but can achieve spectacular gains (box 2.4). There is, however widespread suspicion that such 'win-win' outcomes for environmental regulation are largely theoretical, true only in a few heavily publicised but perhaps atypical examples.

CEMEP notes that such regulatory approaches require both governments and business to assume more risks and run counter to the approaches to environmental policy making embedded in the principles of better regulation. Moreover, even if the net benefits of such regulation could be proved, CEMEP believes the scope for applying such approaches in the UK is limited by UK policy makers and regulators having insufficient technical expertise to implement them effectively.

The interaction of such regulation with the EU and its Single Market are also valid concerns, although CEMEP notes that air quality regulation in California has been successfully enacted despite the very tough federal and litigation barriers in the USA. The justification for innovation forcing is often primarily political and beyond the scope of CEMEP to advocate. However, some Commissioners believe that innovation-forcing regulation could be wealth creating for the UK if combined with the other approaches recommended elsewhere in this Report.

Implementation of regulations

Once an environmental policy has been decided upon, and the appropriate policy instrument selected, the relevant legislation must be implemented according to a clear and unchanging timetable. Where changes are necessary, early communication and clarity about their scope and nature is essential to maintaining investor confidence. Investment has been undermined when expected legislation was delayed or when the approach to implementation was changed during the process.

The Waste Electrical and Electronic Equipment (WEEE) Directive provides a good example of the impacts of delays on investment (box 2.5).

Box 2.4: Californian air quality legislation and auto-catalysts

In 1970, amendments were passed to the US Clean Air Act requiring a 90 per cent reduction in vehicle emissions by 1975/6 from a baseline of cars sold in 1970. The target was simple. There were no air quality problems in California in 1940. There were 90 per cent more cars on the road in California in 1970 than 1940, and serious air quality problems. So reducing emissions by 90 per cent would solve the problem.

The regulator's technical expertise and understanding of what innovation could deliver was decisive in enabling it to weather the storm of resistance to the amendment, including legal challenges on cost/benefit grounds from vehicle manufacturers. By 1975, catalytic converters were being installed in 80 per cent of new vehicles. A market for auto catalysts was created which has sparked a technological revolution leading to a thousand-fold reduction in emissions at no higher cost in real terms than when originally introduced in 1975.

The US Environmental Protection Agency valued the total monetised health benefits achieved through 1990 at $22.2 trillion and the total compliance costs over the same years at $0.5 trillion. The resulting net monetary benefits of $21.7 trillion make the Clean Air Act one of the most cost-effective regulatory programmes in history.

Proposed forthcoming legislation, such as the landfill bans for certain materials proposed in England's Waste Strategy 2007, or the implementation of the Energy Using Product Directive, must avoid a similar fate. Problems with implementation are likely to make businesses less likely to invest in anticipation of new markets being created by future environmental regulation, encouraging an approach of doing the minimum necessary for compliance.

Recommendation 4

Government should ensure that it sets out and adheres to well-defined timetables for the implementation of environmental legislation. Examples of where this would be relevant are implementation of the Energy Using Products Directive (EuP), and the proposals in England's Waste Strategy 2007 to consider landfill bans for certain materials (should these be taken forward).

Box 2.5: Effect on investment of delays and uncertainty in WEEE Directive implementation

The Waste Electrical and Electronic Equipment (WEEE) Directive aims to minimise the impact of electrical and electronic goods on the environment, by making producers responsible for collection, treatment, and recovery of waste electrical equipment, and allowing consumers to return waste equipment free of charge. The Directive was due to come into force by 13 August 2005, but was actually implemented, after delays, in the UK in January 2007.

It had been estimated that some 1 million tonnes of waste electrical and electronic equipment would need to be processed each year, and in fact manufacturers of nearly 1.5 million tonnes per annum have been registered as producers. Many businesses made investments in anticipation of an increase in material to process, on the basis of the initial implementation policy and timetable. For example, one company built a large fridge recycling plant in 2002, opened a WEEE computer recycling plant in December 2005 and took over a plastics recycler in Germany in October 2006.

The delays, combined with a series of policy changes and a lack of clarity over the implementation of the Directive, have had a negative impact on the return on such investments.

"…*for those businesses that have begun investing in procedures and processes to deal with WEEE, this further uncertainty and delay will not be welcome. The fact that other EU Member States are pressing ahead with implementing the WEEE Directive will also cause problems*…" Institute of Directors, responding to Government's decision to delay implementation of the WEEE Directive late in 2005.

2.1.4 Policy Appraisal

Government needs to find ways to harness market dynamics and innovation to deliver policy objectives. But policy making is still too often predicated on finding the most cost-effective solution to achieving a discrete environmental policy objective based on the current best available technologies. Creating new options that could deliver better solutions at less cost is seen as a separate activity, normally involving public research funding. Reshaping environmental policy design and implementation to take on an explicit remit to promote innovation requires:

- finding ways to value innovation properly in public finances;
- maximising opportunities for investment, innovation and profit as well as minimising costs;
- understanding the risk-reward incentives for investors;
- joining up innovation and environmental policies in recognition that innovation commercialises in 'lead markets';
- making Government processes less bureaucratic and cumbersome in recognition of the importance to business of time to market.

Environmental policy appraisal

Formulation of policy in the UK has a long tradition of rigorous appraisal, supported by a framework of guidance ranging from HM Treasury's Green Book to Impact Assessments. The pursuit of economic efficiency, made explicit in Cost-Benefit Analysis (CBA), is essential for reconciling environmental policy and competitiveness.

The experience of Commissioners is that appraisal processes have tended in practice to place the focus on currently available solutions and current costs, largely because that is where reliable, monetised data are most easily found. Such an approach is particularly suited to environmental policies that have clear, discrete, short-term objectives. It has often avoided unnecessary costs in traditional environmental regulation, which has generally only required improvements based on end-of-pipe technology that a regulator has concluded is reasonably cost-effective.

The transition to a low-carbon, resource-efficient economy is however fundamentally different in scale and character to tackling point-source pollution. While the pursuit of economic efficiency is essential to reconciling environmental policy with competitiveness, too narrow a conception of economic efficiency, based on short-run costs and benefits, runs the risk of locking in businesses and the economy to today's technologies, and can prevent desirable environmental goals even from being articulated. As a consequence, novel technologies with promise in the longer term, but still high on the experience (cost) curve, will be neglected and remain far from the market.

CEMEP believes an approach is needed that allows for the potential of innovation and investment to deliver better, cheaper solutions to be better taken into account. Finding ways to value the future benefits of innovation, in a way that realistically reflects the financial and risk-reward perspectives of the private sector innovator, would greatly enrich the contribution of policy appraisal to the longer-term health of the economy.

The UK's Defence Industrial Strategy (box 2.6) shows that value for money can be achieved in defence procurement at the same time as explicitly placing a value on maximising future benefits, including future UK defence capabilities, technologies and expertise, thereby helping to safeguard and promote jobs in the UK. CEMEP's case study on Britain's ageing water infrastructure (box 2.7) illustrates that taking a broader approach to costs and benefits can have a real impact on future competitiveness as well as the environment and quality of life.

Commissioners note that a new Impact Assessment process, launched earlier this year, aims to strengthen provisions for recording environmental and social as well as economic costs and benefits, and explicitly incorporates an assessment of impact on carbon emissions, as well as on other environmental issues and sustainable development. CEMEP recommends that Government assess the effectiveness and scope of the revised Impact Assessment process, and gather evidence on methods for taking into account long-term needs and opportunities in policy appraisal. Business schools could usefully offer some of their expertise to Government on innovation appraisal. Provision must also be made to make effective use of these methods within Government, through recruitment of officials with the necessary technical expertise and through suitable training, for example at the National School of Government.

Recommendation 5

Government should commission a study of how the long-term needs and opportunities from innovation can be incorporated into cost-benefit analysis guidance, with a view to assessing longer-term impacts on economic performance routinely in environmental policy appraisal.

Box 2.6: Defence Industrial Strategy

The fundamental aim of the Government's Defence Industrial Strategy is to equip UK Armed Forces efficiently with the tools they require to meet the challenges they face. But, within this context, it seeks to maximise economic benefit to the UK from defence expenditure, to recognise the contribution that an innovative defence industry makes to employment and the economy, and enhance the competitiveness of UK industry. The strategy makes clear that procurement decisions, including designing procurement strategies and setting assessment criteria for competitions, should be based on long-term value for money – including whole-life costs and looking more widely than individual projects – and taking into account wider factors including security of supply, UK industrial capabilities and strengths in key technologies and export potential.

[Source: *Defence Industrial Strategy. Defence White Paper Cm 6697*, Ministry of Defence (2005)]

Box 2.7: Renewing Britain's ageing water infrastructure

The UK water sector has problems with ageing, leaking underground networks. Half of the distribution system in London is over 100 years old. Other countries are facing similar problems. Technologies exist to make underground assets more 'intelligent', ranging from simple asset tagging, to real-time monitoring and problem diagnosis and even some self-repair capabilities. Combined with advances in non-invasive and trenchless repair technology there could be significant benefits including: lower maintenance and replacement costs; improved network performance (reduced leakage from the water network); better customer service and reduced wider social and economic costs.

This offers an exciting new market opportunity in an area where the UK has good capabilities. A large renewal programme is underway, which could provide lead markets in the UK. However, most renewal programmes are installing 'dumb assets'. This is because the investment cannot be justified on cost-benefit grounds under the regulatory regime.

- First, more intelligent assets are likely to have higher initial costs with the benefits accruing over the asset life and largely back-end loaded i.e. when the assets fail after several decades. The key issue is how these future rewards can be brought forward to justify investment.
- Second, the wider benefits to society in the form of reduced traffic congestion resulting from utilities digging up the road – currently estimated to cost £5 billion per year – are not taken into account in cost-benefit analysis. There might be a cost and benefit transfer between different groups, as the cost of technology may lead to higher customer bills while the benefits from reduced congestion are felt by a wider group. Moreover, these benefits will not be fully realised unless all utilities adopt similar approaches.

Science and innovation strategies

Government Departments and many agencies publish science and innovation strategies. But many of these focus only on research to provide information for policy formulation and do not address the Department's or agency's role in inducing and rewarding private sector innovation that furthers the Government's objectives, including on the environment. CEMEP recommends that science and innovation strategies should better reflect the opportunity of environmental markets, and that the requirement to produce them should be extended to key regulatory agencies and procurement functions.

Recommendation 6

Government Departments' and regulatory agencies' science and innovation strategies should not focus only on the use of science to support policy, but should address their role in inducing and rewarding private sector innovation that furthers the Government's environmental objectives.

2.1.5 Barrier Removal: Testing and Certification

Many environmental innovations face barriers to market entry because current markets can be structured to suit incumbent technologies, and incumbents often may not bear their full external costs.

As barrier removal tends to be very market-specific, CEMEP has focussed on the generic issue of delays in getting new products to market. Product approval is particularly difficult where established standards do not exist, as can be the case for innovative products. In the environmental sector, these problems are compounded by the absence of pro-active industry groups or 'tier 1' suppliers[6] driving standards for new products being developed.

This problem has been recognised by bodies such as the Carbon Trust, which has developed a programme of activity dedicated to helping businesses overcome technical and market barriers to the deployment of innovative technologies using tools such as field trials and performance monitoring and evaluation. At the EU level, the European Commission has put forward proposals for an EU Environmental Performance Verification scheme to help address some of the problems faced by environmental innovators. On the other hand, CEMEP notes that the Environmental Innovations Advisory Group (EIAG) reported that the problem of obtaining rapid certification of new environmental technologies had proved intractable.

EIAG specifically highlighted the difficulties faced by many small firms in obtaining certification for innovative products in the sustainable construction field (box 2.8).

Customers in this field often have little incentive to make the switch from tried and tested products and processes to more sustainable alternatives, and certification is particularly important to overcome this. But EIAG found that lengthy timescales for obtaining certification increased costs while unexpected delays in getting a product to market could disrupt a business plan by making progress to securing orders slow, in turn restricting and delaying investment.

One significant obstacle is that the emphasis of testing and certification regimes is largely on finished products, neglecting the need to document the performance of new products at key stages of commercial development, in order to assess market readiness or reassure investors. One approach to tackling this suggested by officials at the British Board of Agrément (a body which approves new construction products) is to undertake a formal failure mode effects analysis (FMEA) of a new product before it gains full approval, so that potential purchasers have an independent view of the status of, and unresolved issues with, a new product. Improving the information available in this way would help the market to function better and CEMEP recommends that this approach should be explored further and, if successful, adopted by other approvals bodies. More generally, Commissioners propose that Government review the approvals regime for sustainable construction products, with the intention of adopting a more market-focused, innovation-friendly approach, in line with better regulation principles.

[6] A tier 1 supplier is a business-to-business company that provides consumer-facing companies further along the supply chain with subsystems or major components. They are critical for management of earlier parts of the supply chain and for materialising its innovations.

Recommendation 7

Government, business and the relevant bodies should review the product approvals regime in the construction sector to better understand the barriers to introducing innovative, sustainable products. Measures should be identified to overcome these barriers and, where appropriate, applied more widely.

Box 2.8: Testing and certification of sustainable construction products

Product testing and certification has been identified by small firms in the environmental sector as one of the most significant challenges they face in bringing an innovation to market.

Certification is an assessment that provides unbiased and technically robust documentation of product performance (other types of product assessment are also available). It documents that a product meets a standard or other specification such as regulations. It usually involves product testing in registered laboratories and is conducted under strict protocols established by bodies such as BSI British Standards.

Innovations are often perceived by the end user as being more risky than incumbent technologies or products. Certification can help lessen this risk by providing an assurance to purchasers that the product will meet their requirements. Certification is particularly important to securing market entry in the sustainable construction field.

EIAG looked in more detail at the testing and certification regime for sustainable construction products. It found the regime was far from user-friendly and lacking in proper guidance, meaning that companies underestimated the difficulties involved or struggled to use the system to their commercial advantage.

EIAG proposed a twin-track approach:

- providing better guidance and advice to help innovators navigate this complex process and understand how it can best be applied en route to market;
- making the system itself more user-friendly, including developing fit-for-purpose, low-cost, rapid assessments for new environmental technologies and products.

[Source: *Environmental Innovation: Bridging the gap between environmental necessity and economic opportunity. First report of EIAG,* Department for Trade and Industry (2006)]

2.1.6 The Regulated Energy and Water Sectors

In the key environmental markets of energy and water, Commissioners believe that the market failures that result in under-investment in environmental innovation are further compounded by a regulatory failure that provides energy and water suppliers with little incentive to innovate to meet environmental challenges.

The economic regulators' primary duty is to deliver an efficient and cost-effective service to the consumer, which reflects the main policy goal of liberalising energy and water markets when they were established in the 1980s. In both the energy and water sectors, the regulatory regime has delivered impressive results in terms of driving efficiencies, delivering local environmental improvements and security of supply.

The challenge now is to develop a regulatory framework that not only maintains competition and minimises cost to the consumer but also delivers wider environmental policy objectives, especially on climate change. This is already reflected in the regulators' statutory duty to take sustainable development into account, but has seldom followed through to rewarding the innovation that makes it possible.

Commissioners have noted that Ofcom – the communications industries' regulator – has a statutory duty regarding innovation. Ofcom is required to encourage investment and innovation in relevant markets, with significant discretion in balancing this requirement with others. It fulfils this duty by promoting competition through removing regulatory restrictions; by exploring potential future developments in the sector, enabling changes to be anticipated and minimising regulatory cost through delays; and, crucially, by allowing innovation to be duly rewarded.

This successful proactive approach contrasts with the energy and water regulators, Ofgem and Ofwat, who essentially leave it up to the regulated companies to decide how they will become more efficient and whether and how to innovate. It is clear that while companies are 'free' to innovate the rates of environmental innovation in both the energy and water sectors are below what is needed to meet future environmental challenges cost-effectively. Research and development expenditure declined precipitously in energy after privatisation (although the introduction of the Innovation Funding Incentive for power networks has, in a small way, started to reverse this trend) and has halved in the water sector since 1999.

The Sustainable Development Commission has recently recommended several measures by which Ofgem could stimulate more innovation by energy companies[7]. CEMEP's own research has highlighted the innovation challenge in the water and wastewater sector (box 2.9). CEMEP believes there is a strong case for both Ofgem and Ofwat to be given a statutory duty regarding innovation, emulating Ofcom's role in a highly innovative sector. Commissioners recognise concerns about undermining the regulator's purity of purpose (the focus on the interests of the consumer) but believe the regulators' sustainable development duty has already created an inherent tension. Indeed, this tension can be lessened by a statutory duty regarding innovation specifically linked to delivering sustainable development public policy goals that the market alone cannot achieve.

Recommendation 8

Government should review the duties of the economic regulators in the energy and water sectors to give greater prominence to the importance of environmental innovation in meeting sustainability goals, and back this up with guidance as to how a more complex set of duties might be interpreted.

[7] *Lost in transmission; the role of OFGEM in a changing climate*, Sustainable Development Commission (2007)

Box 2.9: Innovation in the water and wastewater sector

The UK water sector is facing significant new challenges. Demand is rising, especially in the increasingly water-stressed South East. The asset base is ageing and leakage-prone. Moreover, climate change raises the likelihood of increased flooding and water resource problems, and means that tighter environmental standards must be met while reducing carbon emissions.

Tackling these will require targeted investment in research and innovation to find better solutions, such as intelligent metering and underground assets, better leakage and energy management and the development of chemical-free waste water treatment. Moreover, as most of these challenges will be faced worldwide it could create opportunities for new growth in a sector where the UK already has a strong global reach.

A report on 'Barriers to Innovation in the UK Water Industry' commissioned by UK Water Industry Research (UKWIR) concluded that a misalignment of expectations between the supply-chain, water companies, regulators and Government is limiting the sector's ability to exploit fully its innovative capacity. This is partly due to the conservative, risk-averse business models of the water companies; which in turn reflects the fact that the economic regulation system insufficiently rewards innovation. At the same time, the supply chain is unable to engage in a strategic debate on future needs and process or product development.

In response, the sector has developed roadmaps on areas that will require targeted investment in research and innovation over the next 25 years. Implementing these will require greater collaboration between stakeholders to enable the integration of technology development and better co-ordination of policy to incentivise market deployment. To facilitate this, the sector is proposing to establish business-led Knowledge Integration Communities (KICs), in the following areas:

- reduced per capita 'water footprint';
- reduced carbon footprint;
- reduced disruption due to failure.

Ofgem has sought to address a similar need in the energy sector by introducing two new incentive mechanisms to promote innovation to support the connection of distributed generation. The Innovation Funding Incentive supports increased R&D activity while Registered Power Zones provide an incentive for demonstration and market deployment. Similar mechanisms might be appropriate for tackling the specific needs in the water sector identified by UKWIR.

2.2 Innovation Policy: Market 'Pull'

This section considers what influences companies to invest in the expensive and risky process of commercialising environmental innovations; the need for Government intervention in the form of additional market pull measures, and the most effective policy mix.

Commercialisation of new products takes place in lead markets. Lead markets emerge where the unique properties of an innovation are sufficiently valued or needed by 'early adopters' to command a price premium (i.e. product differentiation). It is this prospect of competitive advantage leading to higher profits and better market share that drives investment in new products.

Measures outlined in the previous section such as putting a cost on pollutants, can change the equation and provide the necessary background for investment decisions. The marginal cost differentiation they create, however, provides only a weak driver for investment and can take a long time to work, particularly as environmental innovation is subject to a range of non-price market failures (box 2.10).

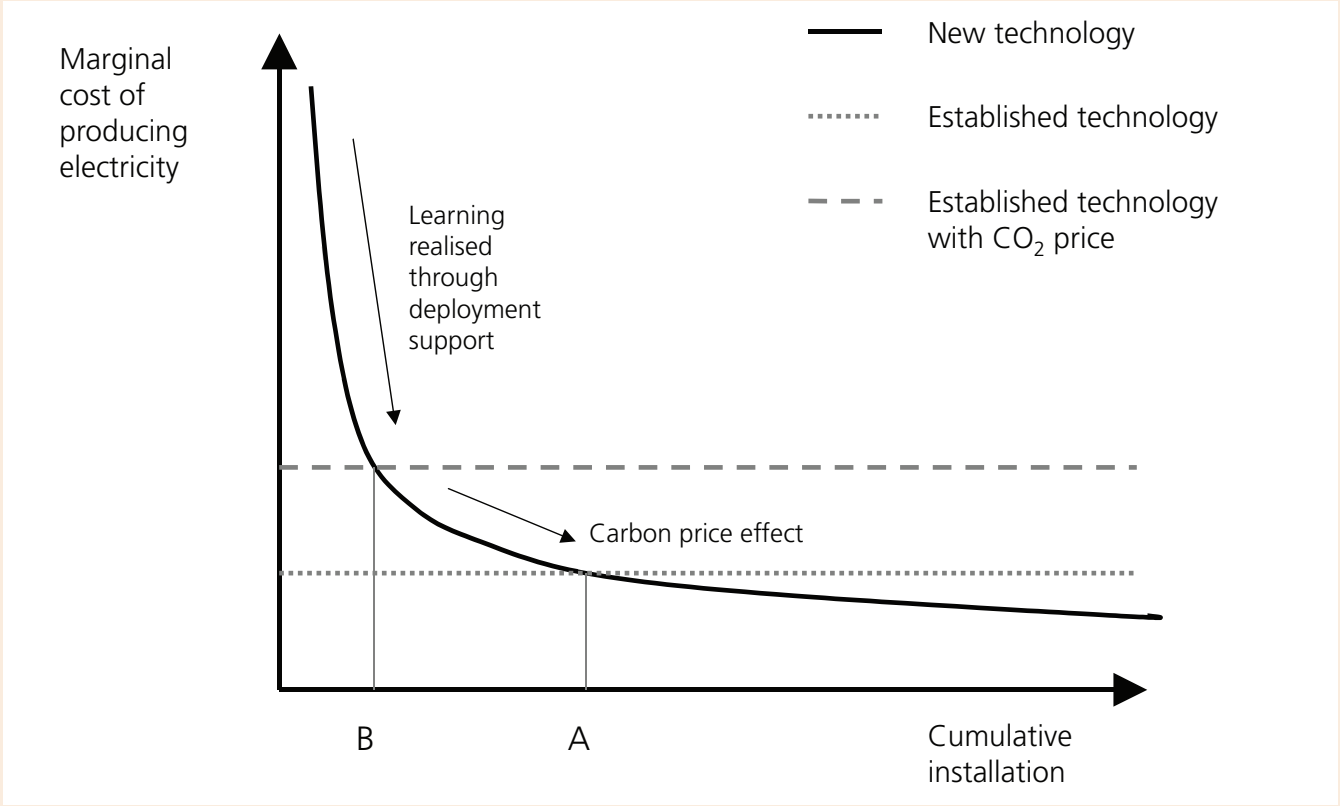
From a business perspective, the key issue influencing investment decisions is not so much costs but whether a new product will sell and at what price. However, product differentiation on the basis of carbon or resource efficiency is currently a very weak source of competitive advantage; the cost savings either to the manufacturer or the user are small, and there are few buyers for whom environmental efficiency is a significant factor compared with overall price, performance and availability. Thus, for most environmentally-differentiated products, the market need for something new is not sufficiently compelling to justify the investment.

To influence investment decisions, market pull measures therefore need not only to change the cost equation but also to create or articulate a future market where low carbon and other environmental characteristics are a credible source of competitive advantage. This will promote commercialisation of environmental goods and services by stimulating investment that would otherwise not have occurred and enable progress down the experience curve as rapidly as possible.

It is important to avoid using market pull measures that lack this future market element or encourage product differentiation in economically inefficient ways, such as subsidies that result in higher costs than are desirable or forms of regulation that have unintended effects. Market pull measures should also be outcome-focused, as far as possible not presupposing or favouring a specific technical solution.

The Government's King Review of low-carbon cars provides an opportunity to promote such a market by taking account of the need to consider the creation of lead markets as well as grant support. The Department for Transport's Low Carbon Transport Innovation Fund should be used to support demonstrations linked to procurement opportunities rather than isolated initiatives with no carry-through to markets and business investment.

Box 2.10: Costs and lack of investment in low-carbon power generation



Experience curve for a new low-carbon power generation technology. With the introduction of the carbon price, a new technology becomes cost effective at point B rather than point A, reducing the learning cost.
[Source: *Stern Review, Figure 16.6: Interaction between carbon pricing and deployment support*]

The early deployment costs at the top of the above experience curve can be considered an investment in new technology that will realise gains once the cost falls below that of the old technology. But in power generation little or no value is attributed to the cost advantage over time implied by the experience curve, and such investments are rare. There are several reasons for this.

- *Finance*: The scale of the deployment support phase may be too large for individual companies to finance. This is the basis of the Stern Review argument for deployment support.
- *Technological risk*: The relationship illustrated in experience curves is one of improved performance leading to more benefits and/or lower cost, leading in turn to increasing sales and hence to investment in capacity. This works best when there are early market segments or 'lead markets' in which technology improvements can be made and where initially lower performance or higher costs are still competitive. Lead markets are largely absent in electricity generation.
- *Market risk*: While lower costs are clearly an advantage, any investment also depends on revenues and it is the uncertainty about these that inhibits investment. As Stern points out, variability in carbon cost increases the revenue risks and further discourages investment and innovation.
- *Intellectual property*: The classical method of retaining competitive advantage down the experience curve is via patents. The effectiveness of patents is variable and in most energy and environmental technologies they provide lower rewards than other sectors. There are many reasons for this including the nature of the patents themselves, the commodity nature of energy and the use of environmental regulatory standards that specify cost-effective (i.e. cheap and widely available) solutions.

2.2.1 Public Procurement

Public procurement is favoured by CEMEP as a market pull measure because of its inherent flexibility. Procurement is well suited to providing the correct balance between costs and benefits of specific products and services, provided whole-life costs are considered and environmental and sustainability benefits are correctly valued. In this way any extra costs are only incurred because they are 'worth it' to the end user.

Many private sector companies, for example the large retailers, are already engaged in the process of positioning better environmental performance as a product feature, believing that this gives them a competitive advantage with the consumer. However, environmental performance is still only a business-critical matter for a relatively limited number of companies. This means there is a huge opportunity for the public sector to amplify the role of low carbon and other sustainability characteristics in products in their purchasing requirements, creating a credible market need for these features so that business will invest in them to gain competitive advantage.

Forward Commitment Procurement

By using the Forward Commitment Procurement (FCP) process (box 2.11) the public sector can shorten the timescale of the experience curve and encourage private investment against the firm prospect of future sales if price and performance meet the future needs. It is a simple but very powerful mechanism that can unlock private sector investment in innovative solutions.

The Environmental Innovations Advisory Group (EIAG) is working with BERR, Defra, the National Health Service, the Office of Government Commerce and the Greater London Authority to harness the power of Government procurement to transform the market for a new generation of innovative and energy-efficient lighting, making it more affordable and widely available. This initiative provides an opportunity to replicate the FCP approach in the delivery of new solutions to help the Government estate to meet its energy-efficiency commitments. It will also generate market conditions that should enable companies operating in the UK to become players in a global market for energy-efficient lighting expected to be worth $150 billion by 2020, helping to promote and safeguard UK jobs and skills.

There is no shortage of possibilities for transforming other markets in a similar way, and CEMEP welcomes the commitment in the Government's Sustainable Procurement Action Plan to replicate the FCP model more widely in the public sector. CEMEP believes there are two essential elements to achieving this in practice: first, a more systematic process is needed to identify where better, more cost-effective solutions are needed to achieve environmental policy objectives and targets; and second, the public sector's capability to carry out this type of supply chain management practice needs to be developed and enhanced.

There are a number of steps the Government could take. For example, Departments could be challenged to identify policy objectives and targets requiring better, more cost-effective

Box 2.11: Forward Commitment Procurement

The Forward Commitment Procurement (FCP), pioneered by the business-led Environmental Innovations Advisory Group (EIAG), involves providing advance information of future needs, early engagement with potential suppliers and – most importantly – the incentive of a Forward Commitment: an agreement to purchase a product that currently does not exist, at a specified future date, providing it delivers agreed performance levels and cost.

solutions. Forward Commitment Procurement could be incorporated in sustainability schemes; for example, the 'Zero Waste Places' initiative, announced in the Government's 2007 Waste Strategy for England provides an ideal opportunity for the public sector to signal to the market a credible requirement for innovative waste management technologies (box 2.12).

Critical mass across the public sector could best be achieved by establishing a scheme to enable the public sector at all levels to make greater use of Forward Commitment Procurement. This should be based on a number of key 'challenges' where policy needs and economic opportunities are greatest, for example, zero-emission schools with carbon-neutral construction and on-site energy generation. The scheme should be run on a competitive basis with successful bids receiving support and practical assistance to help bring better than available solutions to the market. Such an approach would combine the identification of real unmet needs with giving the public sector the capability to engage effectively with the market to deliver them.

Box 2.12: Zero Waste Places

The Zero Waste Places initiative invites cities, towns and rural communities to become 'exemplars of good environmental practice' and be 'pathfinders' to identify solutions for others to adopt. It is explicitly aimed at developing innovative and exemplary practice. This is a useful approach. However, it could go further by using market pull to secure better than available solutions and redefine current best practice in a sector that is ready to invest in innovation, given the right signals from its customers.

If it were to enable participating places to adopt the Forward Commitment Procurement model, the Zero Waste Places initiative could be pivotal in:

- creating new solutions that are not currently available in the market place;
- stimulating investment in emerging technologies;
- making new and emerging technologies affordable; and
- speeding up their entry into the market.

Potential examples of unmet need include:

- City centre authorities: a waste management solution to eliminate the requirement for the collection of non-recyclable waste from high-rise housing developments;
- County Councils: products that would enable authorities to set a goal of procuring nothing non-recyclable in five years' time for their offices and catering premises;
- Publicly-procured building projects: on-site, easily-maintained solutions for sorting waste, storing recyclables, treating degradable waste and dealing with residuals.

Recommendation 9

Government should facilitate the scaling-up and replication of the Forward Commitment Procurement (FCP) model in the public sector by:

- **identifying where better, more cost-effective solutions are needed to achieve environmental policy objectives;**
- **developing the public sector's capability to engage effectively with the market using FCP, including by establishing a 'Challenge' scheme; and**
- **adopting the FCP model for the 'Zero Waste Places' initiative.**

2.2.2 The Use of Environmental Mandates

While CEMEP regards procurement as a particularly flexible tool for placing environmental needs at the centre of private investment processes, it is not the only option. Regulation can be another powerful way of creating important early markets and stimulating innovation and investment. The California Zero Emissions Mandate (box 2.13) provides a well known example.

If reflected in building regulations as planned, the Code for Sustainable Homes (box 2.14) would create an ambitious mandate for zero-net carbon homes in England. Building such homes cost efficiently and at scale will require new technologies and techniques that have yet to be developed, creating new economic opportunities. Using market pull measures including public procurement in conjunction with such regulation can help ensure these opportunities are maximised.

Box 2.13: California Zero Emissions Mandate

By creating the first market for today's fuel-efficient hybrid and super-clean vehicles while gradually making the mandate more ambitious over time the California Zero Emissions programme has stimulated innovation and investment around the world in areas such as advanced components for electric vehicles and fuel cell technology. The entire Zero Emission Vehicle (ZEV) Regulations were contained in one sentence:

"While meeting the fleet average standard each manufacturer's sales shall be composed of at least 2 per cent ZEV's in the model years 1998 – 2000, 5 per cent in 2001 and 2002, and 10 per cent ZEV's in 2003 and subsequent years."

By providing an early lead market for low and zero emission vehicles, this simple rule has stimulated innovation around the world which has resulted in:

- development of fuel cells to the brink of commercialisation;
- development of key components of electric vehicles;
- commercial introduction of fuel-efficient hybrid vehicles.

Box 2.14: The Code for Sustainable Homes

The Code for Sustainable Homes sets benchmarks for environmental impacts of new homes in England. The intention is that by 2010 all new homes will use 25 per cent less energy than today's minimum regulatory requirements, by 2013, 44 per cent less energy, and by 2017 they will be 'zero net carbon'[8]. Similar, though less stringent, targets apply for water and materials. Introduced in April 2007, the Code is voluntary but it is proposed that the energy ratings under it will be progressively incorporated into the Building Regulations and become mandatory for all buildings.

2.2.3 Local and Regional Action

Market pull measures, particularly procurement, lend themselves well to local initiatives (regional level or below) where budgets, specific priorities and political will can more easily converge on specific actions (as shown by the work of pioneering local authorities such as Woking and Merton Borough Councils). The value of such local action lies in creating the first in a series of progressive steps that can transform a whole market sector. To demonstrate this point, CEMEP has developed a hypothetical example describing how creating a lead market for zero-emission buses in London might bring forward emissions reductions in other vehicle types, until it becomes possible to establish a zero-emissions zone in the city (box 2.15).

CEMEP believes such opportunities for local action should be encouraged and given further impetus by Government. This could be achieved by designating a number of 'Environmental Innovation Zones' where local area partnerships (involving RDAs, local authorities and businesses) would be empowered to use a range of policy measures to deliver better, more cost-effective solutions to local environmental policy goals[9].

Recommendation 10

Government should establish 'Environmental Innovation Zones' where local area partnerships are empowered to use a range of policy measures to bring forward innovative solutions to deliver unmet environmental goals. This should be seen as the first in a series of progressive steps to transforming market sectors and creating economic opportunities on a wider scale. Successful examples should be replicated and participants encouraged to collaborate, where appropriate, to create economies of scale.

[8] 'Zero net carbon' in this context means reducing energy consumption as far as possible and only using renewable energy sources for the remainder. It does not cover either carbon embodied in the building or in manufacturing renewable energy sources.

[9] This type of approach was advocated in a recent report commissioned by NESTA (National Endowment for Science, Technology and the Arts): *The Disrupters, Lessons for low carbon innovation from the new wave of environmental pioneers*, NESTA (2007)

Box 2.15: A Zero-Emission Zone in London

Zero-emission (including zero-carbon) transport for cities is a highly desirable goal that is frustrated by cost and industry structure problems and is believed to be many years from practical fulfilment.

For example, moving immediately to the desirable end point of zero-emission private cars is hampered by the need for hydrogen and battery recharging infrastructure as well as the excellence of the incumbent technology and the lack of a credible future market of sufficient size. In addition, key technical issues include the availability of zero polluting fuels for conversion to hydrogen or electricity and the capability and cost of the batteries, electric drive trains and fuel cell engines of zero-emission vehicles.

However, the highly segmented nature of the transport market could be exploited to accelerate the required technical and infrastructure developments. This can be achieved by creating early lead markets starting with buses and building through taxis, delivery vehicles, company fleet cars and finally private cars. In addition there are technology stepping-stones such as series, parallel and plug-in hybrids, each with the option of internal combustion engine and fuel cell on-board power. A city the size of London would provide sufficient market pull to kick-start such an approach.

London is already committed to diesel electric hybrid buses and a low-emission zone for heavy goods vehicles. There is sufficient scale of demand for London to use Forward Commitment Procurement (FCP) to accelerate investment in, and demonstration and supply of, fuel cell hybrid buses and make these available at acceptable cost at the earliest possible time. While the majority of the investment to deliver this will come from private companies against the FCP sales opportunity, the Department for Transport's Low Carbon Transport Innovation Fund may be crucial to support technology demonstrations.

Such a development would provide a hydrogen infrastructure centred on bus depots with hydrogen produced from, for example, waste and a sharp reduction in the cost and risks of fuel cell technology. The hydrogen infrastructure could be made available to taxis and extended with stations for fleet commercial vehicles such as delivery vans to allow these to transition from diesels to internal combustion engine hybrids and then to fuel cell hybrids. The 2012 Olympics would provide a desirable showcase for these buses and a suitable timescale.

Cars may follow a parallel path of plug-in hybrids with internal combustion engines encouraged by restrictions or charges for polluting vehicles in London, before the internal combustion engine is replaced by a fuel cell and zero-emission vehicles become a reality.

Central Government could assist by providing other local authorities with powers to specify environmental standards for buses and implementing a national low-carbon bus obligation on bus operators to ensure a growing national market for the hybrid vehicles. Progressive tightening of the emissions regulations together with FCP could ensure a leading role for London while competition would stimulate other cities to follow, providing volume sales opportunities.

2.2.4 Sectoral Deployment Support

Sectoral deployment support is particularly important when product differentiation is hard to achieve, and has been successful in stimulating the development of renewable energy, notably wind power and solar photovoltaics (PV). Targeted at the purchasers of innovative technology, this type of support can help to build scale and reduce unit costs of a technology that is not currently cost competitive.

It may also provide a lead into markets that later become self-sustaining in the absence of policy support. In Germany, continued Government support for renewables is seen as essential in the medium term, but by about 2020 it may be cheaper to supply energy from renewables than from conventional sources. In Japan, solar PV is now a largely self-sustaining market, and deployment support has been gradually reduced over time.

Other examples of sectoral deployment support that has created early markets for emerging technologies include the UK Renewables Obligation and US Renewables Portfolio Standard; feed-in tariffs used to promote renewables in many EU countries; and capital subsidies available in many countries for the adoption of small scale renewables by domestic and small commercial customers. CEMEP welcomes the proposals set out in the Government's recent Energy White Paper to introduce banding of the UK Renewables Obligation that offers differentiated levels of support to different renewable technologies.

To stimulate the development and uptake of renewable energy technologies that would not otherwise be widely adopted, Commissioners believe – in line with the conclusions of the Stern Review – that targeted sectoral initiatives will be necessary in some circumstances. While there are inevitably costs associated with such support, they could prove the best option in the longer term. CEMEP therefore proposes that, where they can be expected to result in overall economic benefit in the long term, such initiatives could be used more widely.

The choice of the appropriate policy measures will depend on the stage of the innovation process being supported (box 2.16). Policies to support investment in high-risk, early-stage options will be most effective if, in addition to providing revenue, they are designed to reduce or remove revenue risks associated with price volatility. Support should target those applications with significant potential for mass-market rollout, and should take into account areas of natural advantage for the UK, such as offshore renewables.

Recommendation 11

To improve the development and uptake of renewable and low-carbon energy technologies in the UK, Government should use targeted sectoral deployment support measures more widely, with careful attention to the choice of instrument for different stages of technology maturity.

Box 2.16: Choosing the right instrument for deployment support

A recently published report by the UK Energy Research Centre suggests a 'risk hierarchy' linking policy to technology maturity in the low-carbon and renewable energy generation sector.

- Capital subsidies and/or PFI equity stakes are most likely to be appropriate for wholly new technologies emerging from R&D, or for unproven and large-scale investments with limited prospect of incremental learning through small-scale early commercial units: e.g. carbon capture and storage and possibly wave and tidal power.
- Fixed-price tariff schemes may be most appropriate for initial roll-out of emerging technologies that are demonstrated, but yet to be used on a large scale: e.g. offshore wind, also possibly energy efficiency schemes in old building stock.
- Market-based schemes, including taxation and 'cap and trade' (see section 2.1) are generally most suited to proven technologies, or to incentivise least-cost means for short-term carbon reduction: e.g. onshore wind.

[Source: *Investment in electricity generation: the role of costs, incentives and risks*, UKERC (2007)]

2.3 Innovation Policy: Supply 'Push'

Supply 'push' consists primarily of support for research, development, and demonstration (RD&D). Targeted support will leverage private sector investment into the technologies required to meet future environmental objectives. Further, it will help facilitate generation of intellectual property and the development of new products and services, building options to meet future environmental needs and potentially creating competitive advantages. Market failures resulting in under-investment in RD&D by the private sector are well established.

Long lead times and high costs of technology development are significant factors in many environmental sectors, particularly energy. They are often compounded by the need to displace low-cost incumbent technologies. Funds for RD&D support are finite and it is important that they are deployed effectively. The level and focus of support must be kept under review and funding should take account of opportunities and UK strengths, as well as the capacity for the research community to deliver outcomes that provide value for money. This section recommends a series of steps that Government should take to ensure that the maximum environmental and economic benefits result from RD&D support.

CEMEP's consideration of RD&D support is based largely on analysis of policy frameworks to drive long-term investment in renewable power in the UK[10]. Radical innovation is needed in the energy sector to address climate change, yet both public and private funding for energy RD&D decreased sharply in the late 1980s and 1990s. But Commissioners believe that their recommendations in this area have wider application in sectors where environmental technology development is similarly risky and capital intensive, such as low-carbon transport, space and water heating and water and wastewater treatment.

2.3.1 Coordinating Capabilities to Leverage Support

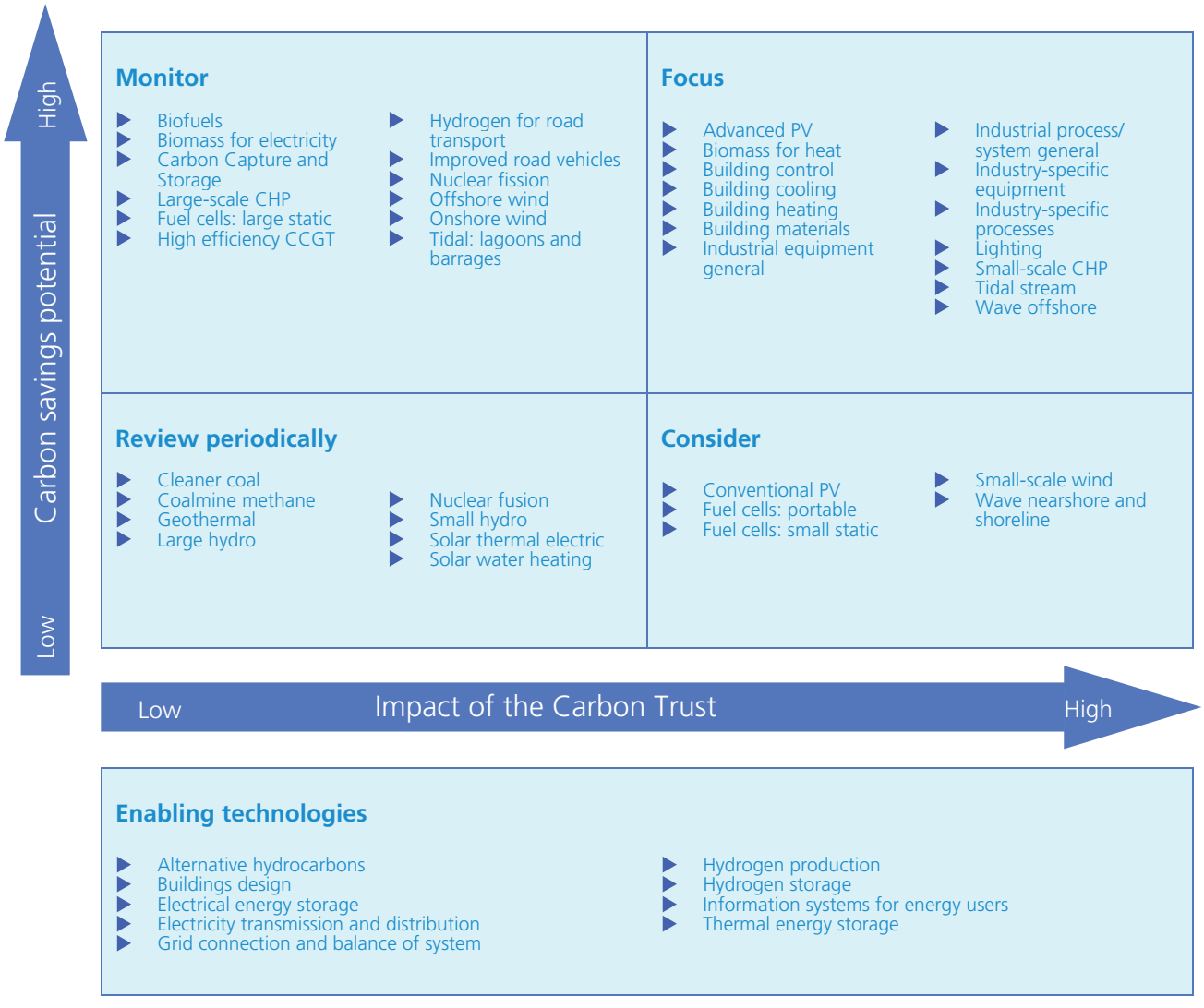
The Government has recognised the importance of expanding support for energy- and climate-related RD&D with the recent announcement of

[10] See, for example: *Policy frameworks for renewables*, Carbon Trust (2006); and *Building options for UK renewable energy*, Carbon Trust (2003).

initiatives such as the Environmental Transformation Fund (ETF) and Energy Technologies Institute (ETI). The recently published Low Carbon Transport Innovation Strategy also includes a commitment to support demonstration projects[11].

Selection of projects and the approach to RD&D support for such new initiatives should draw on abundant existing knowledge and expertise so as to get best overall value for money from the new funds available. The Carbon Trust has already conducted detailed analysis of the UK low-carbon technology landscape to identify key research capabilities, market potential and areas of UK comparative advantage (box 2.17).

Box 2.17: Low Carbon Technology Assessment



[Source: *Low Carbon Technology Assessment*, Carbon Trust (2007)]

The assessment identifies those technologies that offer the greatest carbon saving potential and where support from the Carbon Trust can be material in bringing them forward. The matrix demonstrates the potential to prioritise particular technologies for support. In order to assess UK comparative advantage, the bottom axis would need to be replaced with one looking at the UK competitive position.

[11] *Low Carbon Transport Innovation Strategy*, Department for Transport (2007)

There is a range of other bodies and initiatives with an interest in RD&D support, including the Energy Research Partnership, the ETI and ETF, the Engineering and Physical Sciences Research Council, the UK Energy Research Centre, the Regional Development Agencies and the Energy Saving Trust. Government should consider how best these different bodies can work together to leverage UK resources effectively. This approach should also apply to support for innovation in environmental markets in general.

Synergies must also be created between supply push and market pull measures. Organisations such as the Carbon Trust will be crucial for this, because of their specialist in-depth knowledge and market focus.

One potentially fruitful area of synergy is between Government RD&D support and public procurement. Linking RD&D funding to a procurement opportunity of suitable scale would facilitate private investment and target the funds towards societal goals. Government support for trials and demonstrations within a procurement exercise would be particularly powerful in cases where early stage innovative environmental products or services are initially more expensive than equivalent incumbent technologies. The Technology Strategy Board (TSB) Innovation Platforms could play an important role here. The Innovation Platform approach aims to connect research to markets by harnessing the power of Government procurement budgets in areas of major policy and societal need such as sustainable consumption and production.

Recommendation 12

To leverage best overall value for money from the funds available, existing capabilities and new initiatives in RD&D across the public sector and industry should be better coordinated. Synergies should be sought between different strands of innovation support, including linking RD&D support to procurement opportunities.

2.3.2 The 'Options Approach'

Government should be careful not to 'pick winners' by focusing its attention and support on a single or small number of technologies to address environmental challenges. It is impossible to predict which technologies will be viable and competitive in the future, because of uncertainties both in the costs of development and deployment and in other variables such as fossil fuel prices.

Therefore, a portfolio of candidate technologies should be supported. Few, if any, of these emerging technologies will at first be cost-effective compared with the technologies they are designed to replace. However, it is prudent to continue to invest in them to create an option for commercial deployment if the technology becomes economic in the future. Without what are sometimes relatively small amounts of investment in the interim, this option may no longer be open at the crucial time.

A commonly articulated barrier to the commercialisation of environmental technologies by the private sector is the perception of 'funding cliffs' – the concern that Government grant support is available for early stage R&D, but funding is not forthcoming at the demonstration stage, when technology and commercial risks are at their highest. To overcome this problem Government support should aim to be as consistent as possible, through the life-cycle of a technology's development, to allow that technology to make progress towards commercial deployment. Long-term public support for innovative technologies

is seen where important low-carbon technology breakthroughs have occurred previously, for example Danish support for onshore wind through the 1980s and 1990s and Japanese support for Solar PV from the 1970s.

However, Government funding should never be predicated purely on the basis that a previous stage of development has received funding. Beyond the early R&D stage, underperformance may mean that the option is not exercised and support for further development and demonstration is not forthcoming. Commissioners propose that Government should review its RD&D support at performance milestones to assess whether funding should continue to the next stage. By acting in this way, Government can ensure maximum support for those technologies demonstrating environmental and economic potential, while minimising future funding commitments.

Recommendation 13

An 'Options Approach' should be taken to RD&D support, whereby:

- **a diverse portfolio of emerging technologies is supported as consistently as possible beyond early-stage R&D and through the development lifecycle; but**
- **progress is reviewed at the end of each development stage, and support withdrawn for underperforming technologies.**

2.3.3 Prioritisation of Support

The UK cannot actively support all developing environmental technologies; it is appropriate to prioritise those that have the largest environmental and economic potential. The selection and prioritisation of projects and the approach to RD&D taken by funding initiatives will be crucial to their success and CEMEP recommends that Government should prioritise environmental markets for support on the basis of transparent criteria. These criteria should include an assessment of:

- the scale of the environmental need, both in the UK and abroad, and the potential environmental benefit from the technology;
- the economic benefit that would result from meeting the environmental need at reduced cost through innovation;
- the UK's potential as an attractive location for the development of leading technologies to address the market due to:
  - a favourable policy environment;
  - inherent natural resource advantages (e.g. existence of offshore wind, wave and tidal resource);
  - existing technical or research capabilities;
  - existing supply chain, manufacturing base, and/or business/financial capability.
- the potential for economic benefit for UK-based businesses through export of innovative market-leading technologies or services to other countries with the same unmet environmental needs.

Recommendation 14

Government should develop a strategic capability to prioritise its RD&D support for innovation in environmental markets, using transparent criteria to target those technologies with the greatest environmental and economic benefits.

3.1 Business

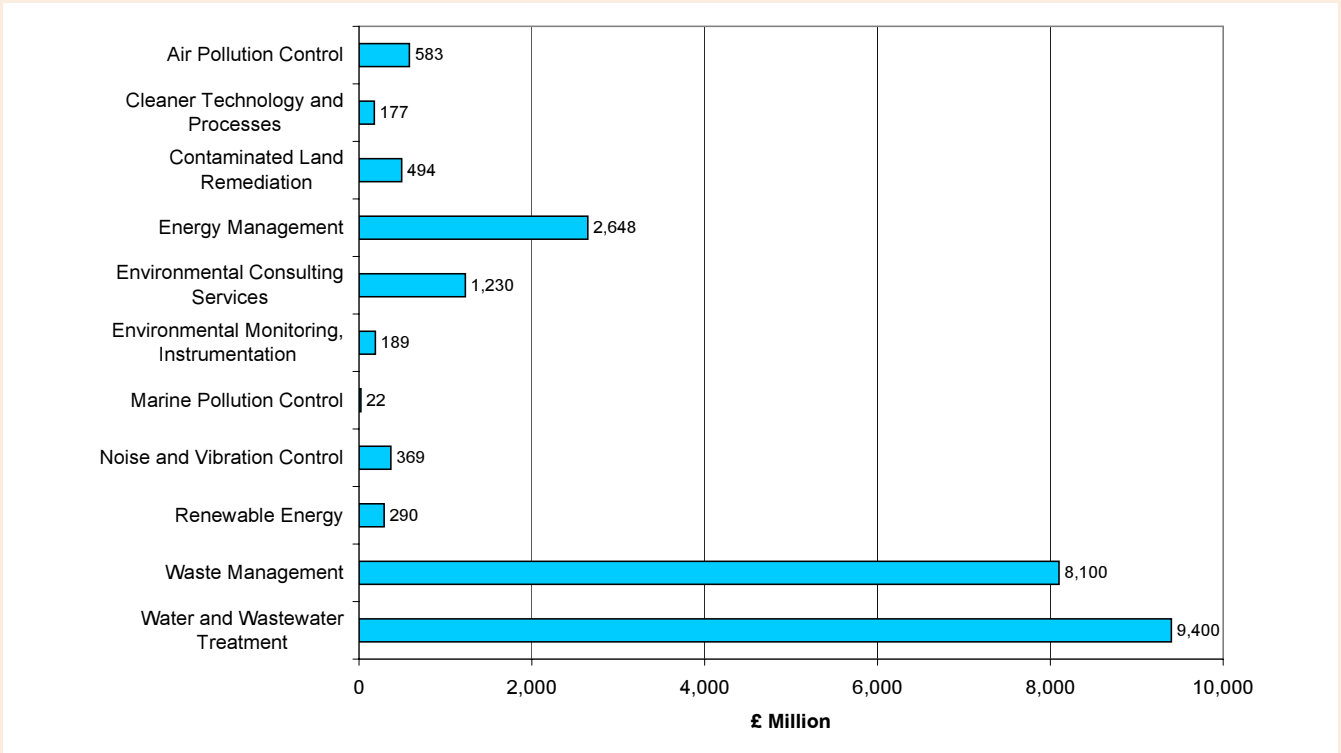
Business is ready to invest in the environment as never before. Driven by political developments, increased public consciousness and the emergence of consumer demand for environmentally responsible products and services, environmental concerns are poised to become core business and are beginning to reshape business strategy and operations. Leading companies are already showing how the commercial opportunities can be exploited.

Creating the right environmental policy framework to stimulate business investment for innovation, and complementing this with direct innovation support measures – as set out in Part 2 – has the potential to accelerate this trend, creating wealth and jobs for the UK. But business, investors, employees and consumers all have a role to play alongside Government in making the most of environmental market opportunities. This part of the Report describes how they will respond when the right policy framework is put in place.

3.1.1 Market Opportunities in Environmental Goods and Services

Environmental goods and services (EGS) already make a significant contribution to wealth creation and employment in the UK. A joint DTI/Defra survey estimated that 400,000 people were employed in environmental goods and services in the UK, with an annual turnover of around £25 billion. Projections based on previous growth suggest that the market will grow to £34 billion in 2010 and to £46 billion by 2015[12]. As defined for this study, environmental goods and services cover activities ranging from pollution control to the development of cleaner processes, environmental consultancy and renewable energy (see figure 3.1).

Figure 3.1: UK Environmental Goods and Services Market by Sub-Sector 2005



[Source: *Emerging Markets In the Environmental Industries Sector*, UKCEED for Department for Trade and Industry (2006)]

[12] *Emerging Markets In the Environmental Industries Sector*, UKCEED for Department for Trade and Industry (2006)

UK strengths

The water and wastewater treatment and waste management and recycling sectors dominate the core environmental goods and services market in the UK. Both sectors, with their associated expertise in design, engineering, consulting and laboratory services, have already spawned a number of market-leading companies.

Other areas of strength and technological expertise in the UK include environmental measurement and monitoring; pollutant removal (including land remediation and marine pollution control); decision-support systems (including energy management and the use of remote sensing); some areas of low-carbon energy generation; and noise abatement technologies[13].

The EGS sector includes many highly innovative companies, and employs a large number of highly skilled graduates and post-graduates. Such innovation- and knowledge-intensive industries can contribute disproportionately to productivity growth and wealth creation in the economy, including by creating significant export opportunities.

Environmental services are a rapidly growing market for UK-based firms, reflecting the country's strength as a knowledge-based economy delivering professional services. The UK is seen as a leading location for environmental consultancy and design services as well as applications expertise, project development and operations management.

It is also emerging as a world centre for environmental financial and business services, particularly in carbon markets (box 3.1 and see Section 3.3, Investors, below).

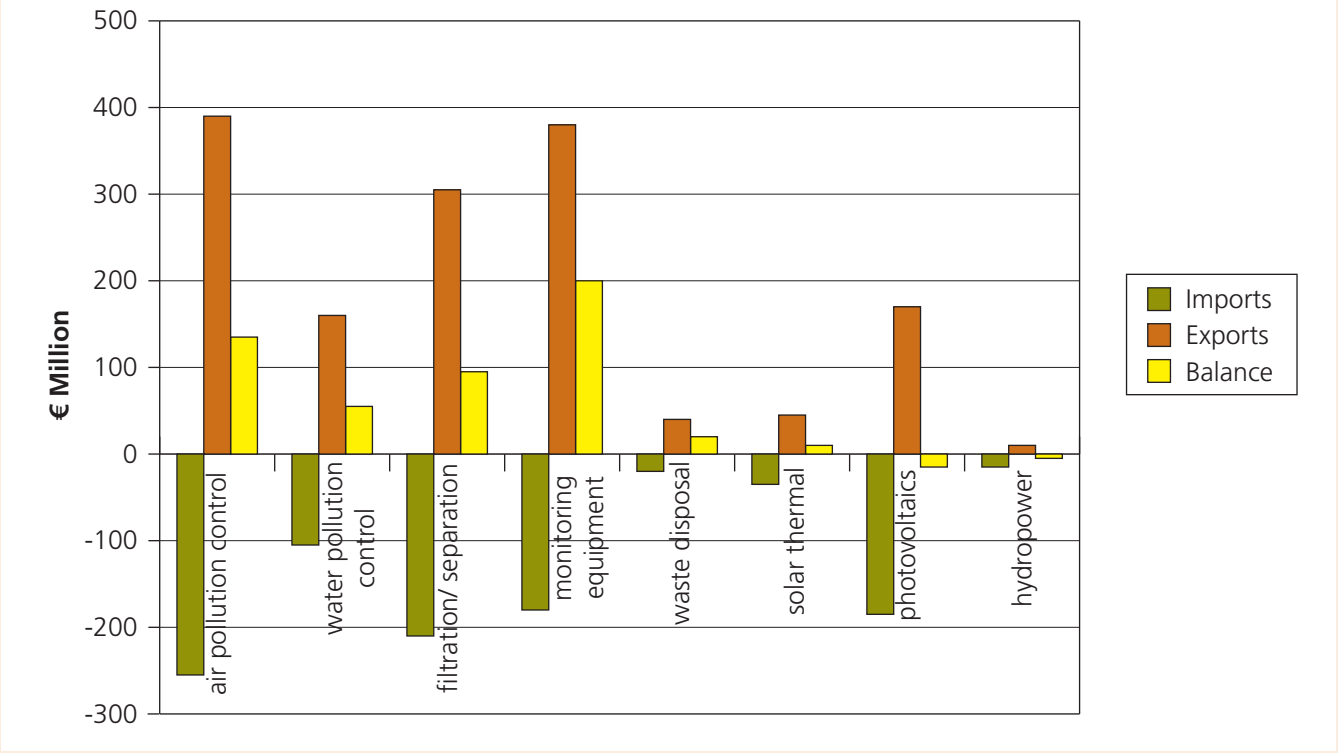
Large environmental goods and service companies are increasingly multinational and geographically mobile. They are currently investing in the UK because they consider the business environment favourable, but could readily be attracted elsewhere if conditions were to change. This highlights the need for the UK to be competitive in attracting investment from multinationals in the sector.

Box 3.1: Carbon markets

The opportunities in carbon markets are large and growing – trading is now worth over $30 billion globally, and this figure would grow fourfold if markets were established in the top 20 emitting countries. ECX, the London-based emissions trading exchange, leads the world and is more than twice as active as its nearest competitor. The EU Emissions Trading Scheme accounts for four-fifths of global carbon trading. The investment flows to developing countries generated by scaling up the Kyoto Protocol Clean Development Mechanism (CDM) could also grow rapidly. Activities in the CDM are estimated to have generated investments of approximately £13 billion in 2006 alone.

[13] *Emerging Markets In the Environmental Industries Sector*, UKCEED for Department for Trade and Industry (2006)

Figure 3.2: UK balance of trade for select portfolio of EGS technologies, 2004



[Source: *Eco Industry, its size, employment, perspectives and barriers to growth*, Ernst & Young for European Commission (2006)]

Export opportunities

The UK is a net exporter of environmental goods and services. In 2004, for a select portfolio of environmental technologies (see figure 3.2), UK exports were around €1.5 billion and imports around €1 billion.

The world's developing economies – in Asia, South America and the former Eastern Bloc – are a large and fast-growing market for environmental goods and services, and present the greatest opportunities for export. The sector is one area where countries such as India and China, investing heavily to reduce the environmental impacts of their rapid economic growth, are importing solutions.

But UK-based suppliers face strong competition from overseas in these markets. Competition comes in particular from Germany (box 3.2), France and some Scandinavian countries in the more mature segments of the market (such as waste management and air pollution), and from the US, Japan and Germany in some younger segments of the market (such as cleaner technologies, photovoltaics and other renewable energy). There is also growing competition from the developing nations themselves, where environmental companies with large numbers of graduate engineers are growing quickly and developing new environmental technologies.

Box 3.2: 'Ecological Industrial Policy' in Germany

The German Federal Environment Ministry believes that Germany is well placed to play a pioneering role in the 'third industrial revolution', as the world's energy-efficiency and environmental engineer. It has proposed an innovation-based environmental policy that represents a 'New Deal' for economy, environment and employment and will achieve a 'double dividend' for the environment and German trade and industry.

It predicts that growth in environmental technology markets will vastly outstrip traditional economic sectors, with a 4 per cent annual growth rate taking turnover in Germany to €1000 billion by 2030.

In the renewable energy sector, the German workforce increased by almost 50 per cent between 2004 and 2006, from 160,000 to 235,000 employees, and is predicted to rise to 400,000 by 2020.

[Sources: *Ecological Industrial Policy. Memorandum for a "New Deal" for the economy, environment and employment*, Federal Environment Ministry (2006); *Renewable energy: employment effects*, Federal Environment Ministry (2006); *Renewable energies create work for 235,000 people*, Federal Environment Ministry press release 245/07 (2007)]

3.1.2 Market Opportunities in the Wider Economy

Environmental markets are about much more than just the suppliers of environmental goods and services. There are opportunities for all businesses, and environmental markets increasingly pervade the whole economy.

The opportunities fall under two main headings:

- improving operational performance by eliminating unnecessary use of energy, water and material resources, including through employee involvement;
- improving sales performance through the promotion of environmentally improved products and services and development of an environmentally aware corporate culture.

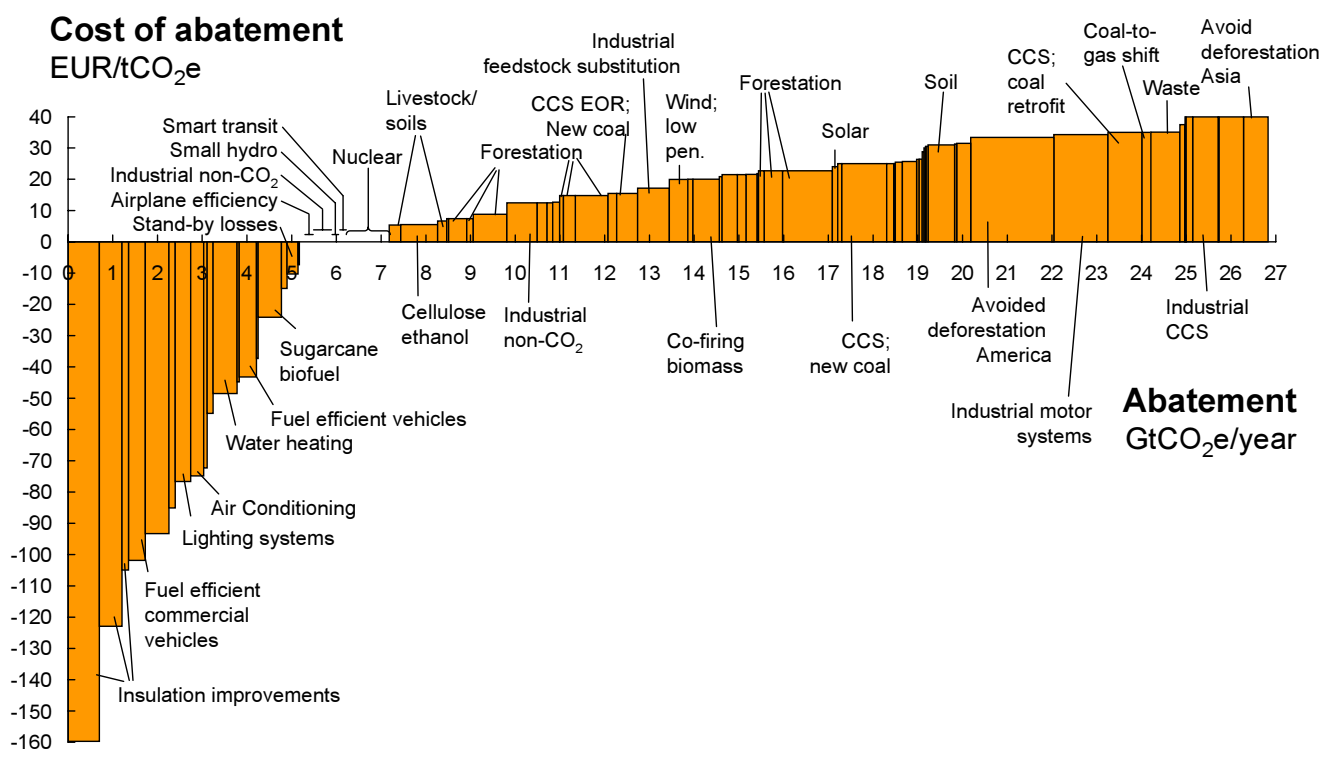
Improving operational performance

Many companies recognise that improving their environmental efficiency is good for business as well as the environment. For example, the cost-effective potential for energy efficiency in all sectors of the economy has been estimated as approximately 30 per cent of final energy demand, with potential financial benefits of £12 billion annually[14].

Much of the potential can be realised by adopting best practice, using existing, and sometimes very simple, technologies and processes (see Figure 3.3 showing negative abatement costs for a number of efficiency measures). The Carbon Trust estimates that 10 to 20 per cent of the energy UK businesses use is wasted through poor control of heating, air conditioning and ventilation and through leaving lights and appliances on when not in use. The TUC's Green Workplaces Strategy is delivering significant energy savings through joint initiatives with employers (see Section 3.2, Employees, below).

[14] *The Energy Review*, Cabinet Office Performance and Innovation Unit (2002)

Figure 3.3: Costs for various carbon abatement measures



[Source: *Vattenfall A.B. www.vattenfall.com/climate*]

A study for Defra estimates that the overall potential resource efficiency gains available to UK business, covering energy, waste and water, are of the order of £6.4 billion per annum[15]. This figure covers only savings from measures requiring zero or low (payback within one year) financial investment.

However, even greater gains in eco-efficiency can be made through the adoption of more radical, innovative environmental technologies and processes. It is in this area that the most significant opportunities to improve competitiveness lie.

Improving sales performance

According to a recent survey of a mixed sample of 151 UK-based companies, regulation is still the biggest driver of corporate environmental behaviour, with two thirds of the sample citing it as very influential. However, there are other significant factors, including meeting customer expectations (seen as very influential by 44 per cent) and comparative advantage (41 per cent), as well as cost-savings (33 per cent).[16]

New, market-based drivers to improve environmental performance are supplementing the traditional primary driver of Government regulation. As a result, the factors that boost competitiveness for a business – enhanced product functionality, high value service, branding and reputation – are increasingly aligned with environmental improvement. This presents opportunities for top-line growth in addition to increasing profits through efficiency improvements.

[15] *Quantification of the business benefits of resource efficiency*, Oakdene Hollins and Grant Thornton for Department for Environment, Food and Rural Affairs (2007 in press).

[16] *Saving the planet – can tax and regulation help?*, PricewaterhouseCoopers LLP (2007)

Businesses can exploit opportunities from increasing environmental awareness by differentiating their products and services, and improving their corporate image, on the basis of environmental performance. There are a number of recent examples of this, most notably the environmental strategy announcements by leading supermarkets in the UK, and the low-carbon products and services offered under the *We're In This Together* campaign (see section 3.4, Consumers, below). Action by large consumer-facing companies can drive improvements up the supply chain, and several supermarkets are undertaking work to look at and address the carbon impact of their whole supply chains. This can generate benefits for smaller UK businesses providing environmental solutions. For example, Marks & Spencer has let a contract for zero-emission vehicles to the Tyne & Wear-based Tanfield Group, a company that has adapted milk float technology for use in delivery vans.

3.1.3 Actions businesses can take themselves

CEMEP believes that the proposals set out in Part 2 will help to stimulate a business response in the shape of a more forward-looking, strategic approach to environmental management, allowing the market opportunities to be exploited. But many UK businesses are still a long way from seeing the environment as a market opportunity. Furthermore, while there is evidence of business-to-business pressures driving environmental improvements along supply chains (as discussed above) the Environmental Innovations Advisory Group (EIAG) has characterised supply chains in environmental markets as generally poorly developed or absent.[17]

In this section, CEMEP recommends a number of actions for business, going beyond the adoption of simple best practice to reduce energy, water and material resource use, to more radical changes that will provide greater value and performance for the consumer at the same time as reducing environmental impacts. These are illustrated with case studies drawn from small businesses to large multinationals.

[17] *Environmental Innovation: Bridging the gap between environmental necessity and economic opportunity. First report of EIAG*, Department for Trade and Industry (2006)

Life-cycle analysis

Life-cycle analysis is an important tool for eco-efficiency, which enables environmental impacts from 'cradle to grave' to be identified and reduced. Impacts may be related to distribution, purchase, customer use or final disposal as well as raw materials and the manufacturing process itself. The Technology Strategy Board has identified the UK as a world leader in life-cycle analysis techniques.[18]

Case Study: Carbon Life-Cycle Analysis of Walkers Crisps

The Carbon Trust has created a business tool for carbon management across the supply chain. In two pilot studies, the Trust worked with Trinity Mirror and Walkers Crisps to measure life-cycle emissions of different newspaper and snack food products, identifying the largest sources of emissions both within the companies' own operations and across the activities of other companies in the supply chain. Together, the studies identified potential savings of 28,000 tonnes of CO_2 and £2.7 million per annum.

In the case of Walkers, the full life-cycle was analysed for three products (Crisps, Quavers and Doritos), considering emissions from raw material production and distribution, through manufacturing and product distribution to disposal and recycling. The Waste and Resources Action Programme (WRAP) and Energy Saving Trust (EST) contributed their expertise, helping to build a mass balance map of material and energy flows through the supply chain. The study drew the following high-level conclusions, and identified potential savings of 18,000 tonnes of CO_2 per annum, equivalent to 8 per cent of the total life-cycle emissions:

- raw materials and manufacturing were the primary source of emissions;
- differences between the three products reflected different raw material choices, packaging and frying or baking processes;
- energy source was as important as energy consumption – using natural gas in frying produced lower emissions than using grid electricity;
- packaging was responsible for around a third of total supply chain emissions.

[Source: *Carbon footprints in the supply chain: the next step for business*, Carbon Trust (2006) CTC616]

[18] *Technology Strategy. Key Technology Area: Sustainable Production and Consumption*, Department for Trade and Industry (2006).

'Cradle to cradle' or 'closed-loop' production

Perfectly serviceable material resources are often wasted by firms who throw them away, sometimes unused, because they cannot find a use for them themselves. For example, it has been estimated that 20 per cent of new construction materials are never used and end up in landfill. Despite the fact that glass is completely recyclable, over 70 per cent of the 3.6 million tonnes of glass flowing through the UK economy each year is sent to landfill[19]. By cooperating with other companies, many businesses have found creative ways to move towards 'cradle to cradle' or 'closed-loop' production, increasing turnover by selling their waste to companies that can use it as feedstock and reducing costs by sourcing recycled materials themselves.

Case Study: Scott Brothers, Impetus Waste Management and Plasrec

When shredded tyres were authorised by Defra for use as a leachate drainage layer in landfill engineering, with the assistance of the National Industrial Symbiosis Programme, two sister waste management companies, Scott Brothers and Impetus, sourced over 5 million used tyres to line an 80,000m^2 site, and identified a tyre recycling company, Plasrec, to shred them. Establishing this cooperation had a number of significant economic, environmental and employment benefits:

- cost savings of £750,000 for Scott Brothers and Impetus, and £1 million for various tyre companies;
- additional sales of £1.5 million for Plasrec;
- attracted £300,000 of private investment;
- diverted 37,500 tonnes of waste tyres from landfill;
- prevented the quarrying of 50,000 tonnes of primary aggregate;
- reduced CO_2 emissions by 400 tonnes;
- created eight new jobs and safeguarded four.

[Source: *National Industrial Symbiosis Programme (NISP) case studies*]

Case Study: Eden Project

The Eden Project in Cornwall has set itself a goal of being 'Waste Neutral' – not just reducing, re-using and recycling itself but also re-investing by buying in as much recycled material as possible to encourage markets for recyclates. Where possible Eden has eradicated disposable (single use) packaging for catering and instead has installed crockery, steel cutlery and a wash facility. However, for those areas where disposable packaging is still needed, Eden has worked with suppliers to trial and establish the viability of compostable packaging, using an in-vessel composter that it has installed. For juice supplier Cornish Orchards, the Eden Project has reduced packaging by using returnable crates supplied with apple juice, which negated the need for single use cling wrap and cardboard boxes. The plant pots for the Eden retail store are now 100 per cent recycled plastic, and through local feeder nurseries and Eden's own nursery project these are now being introduced into the local supply chain. Cling wrap, which in the past would have been sent to landfill, is now collected for reprocessing into items such as recycled polythene bags which Eden buys in, creating a closed loop. The cling wrap supplier now also has its product collected from other customers for recycling. These initiatives are being examined with interest by organisations as diverse as the NHS and the National Trust.

[19] *Glass Manufacture in UK. A fundamental appraisal of the environmental impact of large-scale glass manufacture*, Biffaward Programme for Sustainable Resource Use (2004).

Re-engineering processes

There are often opportunities to re-engineer business processes to cut costs while reducing pollution and resource consumption and avoiding environmental risk. In its analysis of UK industrial capacity in sustainable production and consumption, the Technology Strategy Board cites UK strength in process intensification and clean technologies.

Case study: WBB Minerals

WBB minerals is one of the world's largest producers of advanced industrial minerals to the ceramics, glass, foundry, construction and sports surface industries.

WBB's biggest cost is its £8.75 million annual energy bill for mineral extraction, mainly due to energy used in drying wet sand quarried from the ground. It is thus highly vulnerable to fluctuating energy prices and needs to focus on energy reduction to stay competitive.

Working with the Carbon Trust, WBB identified and implemented new, intelligent control processes for its huge industrial sand driers, representing £700,000 of potential energy savings.

One action point was to invest £21,000 in agitators to help 'spread' the sand as it entered the drier so it would dry more quickly, resulting in savings of £7,500 a year and a three-year payback.

[Source: *Carbon Trust case study PFL208]*

Eco-design

Unnecessary waste is a design flaw. By taking account of environmental factors from the beginning of the design process, step changes in resource- and energy-efficiency of products can be delivered. Eco-designed products may use a smaller quantity and variety of materials and parts and are easier to disassemble and recycle at end of life. They can be cheaper to produce and use, for example by consuming less energy, reducing costs for customers. Often, too, they offer higher functionality and better service, and are simpler and easier to use.

Given other economies' comparative advantages in manufacturing, the UK is unlikely to become a world centre for the manufacture of mass produced eco-designed products, but there are strong potential economic gains to be had in the associated design, licensing and other professional services. The Technology Strategy Board identifies UK strengths in design technologies for sustainable products and design for disassembly, and in technologies for reduced resource consumption during manufacture and in-life.

Case Study: Philips Electronics N.V.

Dutch electronics firm Philips aims to be seen as a credible brand for sustainable products and its consumer research suggests that sustainability is a market opportunity.

Since 1994, it has pursued an eco-design policy, which covers all phases of product development. Products are given 'Green Flagship' status when they are shown to offer better environmental performance than a predecessor or the best commercial competitor in energy consumption and at least two other of the 'Green Focal Areas' (packaging, hazardous substances, weight, recycling and disposal and lifetime reliability). A Life-Cycle Score is also calculated and improvement criteria must be met.

57 Green Flagships were introduced in 2006 and there are over 200 on the market, with total sales of €2.2 billion.

[Source: *Improving lives, delivering value: Philips Sustainability Report 2006*]

Case Study: General Electric

As part of its Ecomagination initiative to produce innovative solutions to solve environmental challenges, US technology company General Electric aims to double revenue from products and services that provide better operating and environmental performance by 2010, to $20 billion (about £10 billion) a year.

Ecomagination certified products range from water desalination platforms to train and aircraft engines, lamps and refrigerators to consumer finance products. To be certified, product performance is evaluated using the Ecomagination Product Review (EPR) scorecard, which quantifies environmental impacts and benefits relative to other products. Product claims are independently verified by quantitative environmental analysis.

Revenue from certified products grew from $10 to $12 billion in 2006. This double-digit growth supports GE's conviction that the launch of Ecomagination will increase shareholder returns. It expects more than half of its product revenue to come from Ecomagination products or services by 2015.

[Source: *Delivering on ecomagination: GE ecomagination report 2006*]

Added-value services

With conventional sales or leasing of goods and utilities, the producer wants to sell more and at a higher price, while the consumer has the opposite interest. Interests can be better aligned by shifting focus from selling products to address more directly the needs and aspirations of the customer. For example, companies can find ways to sell comfort through warmth and light rather than energy, copies rather than photocopiers, or cleaning rather than cleaning products, and can provide additional services such as maintenance, upgrading and exchange.

Higher profits can come from providing better solutions rather than selling more physical products – improving customer value and the bottom line.

The creation and implementation of such new service- or function-based business models is a form of innovation that is often neglected in comparison with the development of new technologies, particularly when considering environmental challenges. But the potential benefits, both economic and environmental, are significant.

Case Study: Energy Services Companies, and the potential for Water Services Companies

Energy Services Companies (ESCOs) function as the interface between the supplier of primary energy and the end user, selling a range of 'energy services' rather than more units of energy. ESCOs have been shown to be successful in achieving energy savings, because they make a life-cycle costed approach to energy use easier to apply in practice, and offer the opportunity for shared savings by aggregating users. ESCOs are beginning to emerge in the UK; for example, Woking Borough Council has created an ESCO through a public-private partnership and EDF Energy have established one for the London Climate Change Agency, with a remit to develop decentralised energy schemes for London. The 2007 Energy White Paper proposed the introduction of a supplier obligation to create further incentives for energy suppliers to profit from providing energy services. Turning the energy companies' business model on its head in this way should not only increase demand for existing energy efficient products but also create demand for innovative technologies such as micro-generation.

The same model is starting to be applied to the water sector. Water Service Companies (WASCOs) can help create demand for both existing water saving devices and more innovative approaches such as dual supply, energy-water systems and storm management. Creating an effectively operating market for water efficiency will require further measures on regulatory and technical issues, such as opening markets to new entrants, trading and smart metering (see section 3.4 below), combined with the use of product standards and building regulations to underpin the market for water efficiency, and better consumer information through, for example, the development of a 'water footprint'. Such an approach has the potential to transform the market for the supply of domestic water, and create significant new business opportunities. New developments such as the Thames Gateway and the proposed eco-towns could provide lead markets for such innovative approaches, which could also include combining water with energy service companies (WESCO's) to develop multi-utility offerings as well as new business models for urban water management.

Case Study: Xerox copiers

Xerox did not introduce its innovative policy of selling copying services rather than copying machines to increase sustainability, but because it believed clients would be much more willing to pay a small amount per copy than a large sum upfront for the copier. However, over time, the environmental benefits in terms of life extension and recycling became clear, as the company created additional value by reusing casings and eventually refurbishing entire machines for re-use in offices at discount rates.

Case Study: Chemical management services

Chemical management services are one of the most successful sustainable service innovations, and account for a high proportion of chemical use in the US, though they are less popular in Europe. If a chemical company switches to providing the service that the chemical is used for, such as cleaning, then it becomes in both the customers' and the company's interest to reduce the amount of the chemical used. At the Spring Hill plant of General Motor's Saturn division, for example, a CMS programme is estimated to have saved $1 million of its $3.5 million annual chemical purchases during 2001.

[Source: Updated from *Service innovation for sustainability: a new option for UK environmental policy?* Green Alliance (2002)]

Recommendation 15

To create market opportunities by improving the eco-efficiency of their operational performance and developing environmentally-improved products and services, business should:

- address the whole life-cycle of products, to enable all environmental impacts from 'cradle to grave' to be identified and reduced;
- investigate the scope for 'cradle to cradle' or 'closed-loop' production, where recycled materials become the feedstock for new products, and spreading new practices through the supply chain;
- assess how to re-engineer processes to cut costs while reducing pollution and resource consumption and avoiding environmental risk;
- investigate the scope for re-designing or re-manufacturing goods, incorporating environmental factors from the beginning of the design process; and
- consider how to create higher profits while reducing resource (including energy) consumption, by selling added value services rather than more products.

3.1.4 Business actions facilitated by Government

Even when action of the kind described in the previous section would provide worthwhile and rapid economic benefits to individual businesses, it is not always pursued. More research is needed to understand in detail the risk/reward calculations employed by businesses when considering measures to improve energy and resource efficiency. But constraints are likely to include inertia, lack of information and in-house expertise, and the transaction costs, such as employee time, of introducing changes. These are particularly significant for small businesses.

Given these constraints, it may be that the potential savings are not large enough to change behaviour. While they are impressive on a whole economy scale, for individual businesses natural resource costs (energy, water, materials) often represent only a small proportion of total costs, and are perceived to be insignificant in comparison with, for example, labour. Management incentives to improve resource efficiency are therefore low, and businesses are more likely to focus on other ways of reducing costs.

Business Advice

To overcome this market failure, Government provides support to business to manage resources efficiently through its sponsorship of a number of delivery bodies, including the Carbon Trust, Envirowise and the National Industrial Symbiosis Programme. The Regional Development Agencies are also actively promoting business resource efficiency, currently piloting a programme of advice and support to 10,000 companies, via Business Link. Metrics collected by the delivery bodies show that they can have a significant impact; for example, for every £1 spent by Envirowise advice and assistance, businesses save £10 through increased resource efficiency.

CEMEP believes that there is a case for reviewing and enhancing publicly-funded support to improve resource efficiency, in order to build on the good work already being done. There should be a stronger focus on providing

more clearly signposted, user-friendly services and understanding the risk/reward drivers for taking up resource efficiency opportunities, particularly for small businesses. There should also be a greater emphasis on 'upstream' measures, for instance promoting re-manufacturing and re-design. Furthermore, with support from trade associations and other representative bodies, further attention should be given to dissemination mechanisms to ensure that successful practices perpetuate and spread, and the full potential for business resource efficiency is realised across the economy.

This review should take account of and, in turn, inform the Government's Business Support Simplification Programme (BSSP), which aims to develop a more effective, efficient, coherent and user-friendly system for all kinds of Government support to business, through a reduced number of individual programmes.

Recommendation 16

Government should consider the need for a longer-term, better-resourced system to advise business on resource efficiency, with more emphasis on upstream measures and dissemination. This should inform the Government's ongoing Business Support Simplification Programme.

Better information for supply chain development

Initiatives such as the Government-sponsored National Industrial Symbiosis Programme (NISP) (see case study in previous section) show the potential for actively promoting supply chain development. Industrial symbiosis brings together companies from all business sectors with the aim of improving cross-industry resource efficiency and competitive advantage through the commercial trading of materials, energy and water and sharing assets, logistics and expertise.

To embed this approach more widely, supply chain management and both public and private procurement professionals need better training and professional development to help them to understand and manage the environmental implications, and improve the environmental performance, of their supply chains. Government and business should work together in this area.

Recommendation 17

Government and industry should work together to improve the provision of training and professional development for supply chain management and public and private procurement professionals, to enable them to better manage the environmental implications of their supply chains.

Accounting for environmental impacts

In addition to the lack of professional expertise, a key barrier to more effective supply chain management is the absence of credible, comparable information about environmental impacts. Standardised measurement and disclosure will not only help businesses to understand where cost savings and new business opportunities might lie, but will enable consumers, investors and procurers to make choices on the basis of sound and trusted information. Recent market research by the Carbon Trust showed that two thirds of consumers would like to know the carbon footprint of the products they buy. As well as for individual products or processes, information is needed at intermediate stages of the supply chain and at the overall corporate level.

Certification of environmental management systems also has a role to play by ensuring that there is accurate measurement and reporting, and that goals of continuous improvement are acted on and passed down the supply chain. This will enable certificates such as ISO14001 to be used with confidence by businesses and public sector procurers alike.

Government and industry must avoid the proliferation of consumer-facing initiatives on labelling and certification. There is a danger that, with a range of different methodologies in use, inconsistencies will become apparent and credibility will be undermined. Key Performance Indicators (KPIs) have been developed by Defra to help companies report on their environmental impacts, but CEMEP Members believe that these may be too complex, and therefore poorly understood, to be widely adopted. A process of standardisation has begun with the recently announced Defra, Carbon Trust and BSI British Standards initiative[20], which is aimed as much at helping businesses to understand their supply chain contributions to carbon, as at informing the consumer about the final carbon footprint of the product.

CEMEP proposes that Government and business should work together to agree and adopt standard accounting and reporting protocols for carbon emissions, material resource consumption and other environmental impacts, and promote these internationally, including through Government's support for the Carbon Disclosure Project (box 3.3). The UK is well placed to develop and champion standards, with strengths in financial analysis, environmental consultancy and environmental economics.

The challenge of developing protocols that are simple enough to be clear to investors, consumers and other stakeholders, yet rigorous and nuanced enough to capture trade-offs and complexities, should not be underestimated. While common standards are in the interest of the private sector, and many businesses have called for them, Government facilitation is required as it is unlikely that the market will develop a single common standard or even measurement principles alone. Once agreed, however, businesses should be prepared to use the protocols routinely to measure and disclose the environmental impacts of their activities, for scrutiny by investors and consumers.

[20] See www.defra.gov.uk/news/2007/070530a.htm

Recommendation 18

Government, business, trade unions and other stakeholders should jointly develop, agree and adopt standardised protocols for measurement and reporting of carbon and other impacts, such as use of material resources and water. These should provide clear and simple, yet robust and credible, information to allow business and consumers to behave in a more resource efficient way, and should be applied at intermediate stages as well as the end of supply chains.

Box 3.3: The Carbon Disclosure Project

The Carbon Disclosure Project (CDP), launched in 2000, is an investor-led, global initiative that aims to provide companies and investors with the best information available on business-related climate risks and opportunities. Based in London, but acting globally, CDP holds the largest registry of corporate greenhouse gas emissions data in the world and its published reports provide a detailed analysis of how the largest companies in the world are responding to climate change.

The data is compiled through a climate change questionnaire that CDP sends each year to the largest publicly listed companies worldwide. CDP aims to agree and advocate a generally accepted international framework for carbon reporting by corporations, and companies are encouraged to report their emissions data according to the Greenhouse Gas Protocol.

CDP makes its information requests and responses from corporations publicly available, The report from the fifth iteration of the Carbon Disclosure Project (CDP5) was published in October 2007. The data presented represent a collaboration of over 315 institutional investors, with assets under management of more than $41 trillion. Although participation in the survey is voluntary, 77 per cent of the FT500 listing of the 500 largest listed companies globally responded.

Material resources will become increasingly important for businesses as prices for some materials rise in the face of huge demand in the emerging economies, as is already happening for metals such as copper and steel. Material resource efficiency is also moving up the business agenda as waste strategies in the UK and Europe push up disposal costs through measures such as increasing landfill taxes and put increasing emphasis on changing the products that create the waste.

Leading on from this, there should be a research effort to understand how reliable an indicator the carbon footprint is for resource use and environmental consequences more broadly. Carbon may be a good proxy for some aspects of resource efficiency because of the energy used to extract raw materials and to make products. This energy is wasted if products make bad use of materials. However, it will be less helpful in pinpointing potentially scarce resources, toxic by-products or water quality.

Recommendation 19

Government, along with business, should sponsor a study of how reliable an indicator the carbon footprint is for resource use and environmental consequences more broadly, and which aspects it fails to reflect.

3.2. Employees

Future sustainable economic prosperity is a core interest of UK employees as their jobs are dependent on it. The shift towards a sustainable economy will directly impact on future employment and skills requirements. A study by the European Trade Union Confederation on the impact of climate change policies on employment in Europe demonstrates that both risks and opportunities to employment lie ahead, due to differential sectoral and occupational impacts. For the TUC, the key issue is securing a 'just transition' to a low-carbon economy for employees, protecting and promoting equality and social justice.

3.2.1 Skills and Employment

Surveys of environmental firms have shown that almost one in three have skills gaps[21]. This represents a barrier to UK success in environmental markets, particularly in renewable and low-carbon energy generation (box 3.4).

Reliable forecasts of future job prospects in environmental markets are not always available. For example, the employment opportunities presented by emerging energy sectors have not been robustly estimated: notably the growth in renewables to meet domestic and EU targets; carbon capture and storage; the installation and use of local renewables and micro generation; clean coal-fired power stations and associated UK coal mining. Without such data it is difficult to build a relevant skills strategy and enlist employer support.

All stakeholders have a responsibility to take this agenda forward. There are a number of existing fora through which relevant information might emerge. In the energy area these include the Renewables Advisory Board, the Coal Forum and carbon capture and storage demonstration projects. Government should map these various fora and consider whether they are sufficient to identify employment opportunities and skills needs in environmental markets.

The Government's Energy White Paper asks the employer-led Sector Skills Councils (SSCs) to report on skills gaps in the energy sector and action being taken to address them. CEMEP welcomes this development, but the whole economy relevance of environmental markets means that there is no single SSC, or even small group of SSCs, who can take the strategic overview required to look at skills for all environmental goods and services. For this reason, a cross-cutting review is needed. The new UK Commission for Employment & Skills, proposed in the Leitch Review of Skills (2006) to increase the voice of employers, would be well-placed to undertake such a review.

Recommendation 20

To better understand where employment opportunities and skills needs are emerging in environmental markets, all stakeholders have a responsibility and a role to play. Government should map the various fora where these issues are already under discussion to help identify whether existing bodies are sufficient to take the agenda forward.

Following the Energy White Paper request to Sector Skills Councils (SSCs) to report on skills gaps in the energy sector, Government should invite the UK Commission for Employment & Skills to review with SSCs the implications for employment and skills of the move to a sustainable, low-carbon and resource-efficient economy, and to make recommendations to Government.

[21] *Environmental Innovation: Bridging the gap between environmental necessity and economic opportunity. First report of EIAG*, Department for Trade and Industry (2006)

Box 3.4: Skills gaps in energy and utilities

In the energy and utility sectors 28 per cent of firms reported a skills gap, as opposed to 20 per cent in England as a whole. The electricity industry is experiencing the most difficulty, with approximately one in two organisations reporting a skills gap of some sort.

A recent research report by the Energy & Utility Sector Skills Council highlighted a significant shortfall in the number of overhead lines workers to deliver the up-coming phase of infrastructure renewal and repair. Senior authorised engineers and project supervisors have to undertake five to seven years of training to become competent.

Work by the London Energy Partnership showed there was a shortage of trainers skilled in renewable energy. Moreover, as there is a large gap between the skills and training available and the needs of the sector, the skills gap is forecast to get worse as the sector expands.

Cogent, the Sector Skills Council for the chemicals, nuclear, oil and gas, petroleum and polymer industries, estimates that the UK will need an additional 8,500 workers with skills in nuclear decommissioning and waste management by 2015, even if there is no new nuclear build.

The Energy Savings Trust has reported that a key barrier to increasing the uptake of new micro-generation devices is the shortage of appropriate skills and training courses for the emerging micro-generation technologies.

[Source: *TUC presentation to CEMEP*]

3.2.2 Employee-led Initiatives

Employees and their trade unions increasingly demand that the companies they work for commit to and act on socially responsible values. Studies have found that a company's corporate responsibility activities have a positive effect on the satisfaction and loyalty of average employees, and help to attract and retain the most talented people. However:

- a Carbon Trust study shows that less than a fifth of employees (18 per cent) feel that their company is doing enough to cut emissions;
- a Labour Research Department study of nearly 700 workplace environmental representatives found that 61 per cent of employers had done nothing to promote green travel plans; and significant proportions had failed to support water conservation (57 per cent), green purchasing (52 per cent) or energy efficiency (23 per cent).

There is huge potential to improve workplace energy and resource efficiency. Harnessing employees' enthusiasm to tackle climate change can play a significant role in an organisation's carbon management programme, helping to extend and increase the effectiveness of activity already underway. The TUC is developing a series of green workplace demonstration projects in the manufacturing and service sectors to raise awareness and build capacity within the British Trade Union movement to address climate change and energy issues at work. Projects at Corus steel works, the large financial services organisation Friends' Provident, the offices of Scottish Power, the British Museum, the Defra office in York, and at the TUC's headquarters and regional offices, have demonstrated:

- enthusiasm to set up joint green workplace projects on the part of both employees and management;
- real reductions in energy use;

- high levels of attendance at climate change events held both inside and outside the workplace, and good response rates to workshops, open days, surveys and 'green reps' training courses; and
- the effectiveness of employee engagement through joint environment committees.

The TUC aims to develop this work programme in the coming year through a 'Green Union Leaders' initiative, further environmental training programmes and other activities.

Recommendation 21

Trade Unions should continue to press for companies to commit to and work for socially and environmentally responsible values. They should provide the necessary support frameworks for their members to lead and participate in workplace initiatives (such as training on resource efficiency) that will generate environmental improvements and increased employee loyalty and satisfaction.

3.3 Investors

Environment as an indicator of investment performance

A growing number of investors agree that integrating economic, environmental and social success factors into business strategy can result in competitive advantage, particularly in the long term. In 1999, the Dow Jones Sustainability Index (DJSI) began tracking the performance of the leading sustainability-driven companies worldwide; it has consistently outperformed the Dow Jones Global Index.

Innovest Strategic Value Advisors, an international investment firm specialising in environmental opportunities, uses up to 60 environmental criteria to rate over 1000 equities for its EcoValue21 investment decision-support tool. Companies with above average ratings reliably outperform lower-rated companies. Innovest claims that this can be used as an indicator for future profitability and that evaluation techniques of this kind allow it to uncover hidden value and risk potential among companies which are often ignored by mainstream investment analysts.

The UK has led the development of the green and socially responsible investment (SRI) industry, which invests in companies that are socially and environmentally responsible and provide solutions to environmental and social problems. As described above, supported by trends in environmental and social policy and regulation, such investments can deliver excellent long-term growth. For example, the Jupiter Ecology Fund outperformed conventional investment funds (as measured by the FTSE World Index) by 45 per cent over the three years to the end of September 2007. The SRI and ethical investment sector has also seen significant inflows recently on the back of such strong fund performance, as well as investor demand for socially responsible investment options (box 3.5).

Box 3.5: Ethical funds

UK investors have recently dramatically increased the amount of money they are putting into ethical funds.

Net sales of UK ethical funds in the first six months of 2007 of £237.5 million were already double the £136.6 million in sales made in 2006. Pure ethical funds now make up 1.4 per cent of total fund sales in the UK.

By the end of the second quarter of 2007, UK retail clients had invested a total of £5.65 billion in ethical funds, up from £4.26 billion at the same time in 2006.

[Source: *UK Investment Management Association (IMA)*]

Venture capital and the stock market

The UK leads in Europe in share and spread of venture capital for clean technology, accounting for almost a third of the total €1.9 billion invested across Europe in recent years. While energy attracts most investment, the UK has attracted capital in a wide range of environmental sectors including materials, transport, logistics, water and air quality, and investments are more diverse than in Germany, for instance, where energy accounts for 92 per cent. The London venture capital market invested £210 million in clean technology companies in 2005, 19 per cent of the £1.1 billion invested in total.[22]

But while the UK is the leading venture capital market in Europe, it lags significantly behind the USA in scale and pace of growth. After eight straight quarters of growth, clean technology became the third largest venture capital investment category in North America in 2006, trailing only IT and biotechnology. The relative lack of investment in the UK means that the so-called 'valley of death', whereby innovative firms fail because of a gap in funding on the path to commercialisation, is still a problem, particularly when large scale demonstration projects are required. The proposals in Part 2 of this Report aim to address this, but gaps in the commercialisation process should be monitored and analysed carefully by both Government and the investment community.

There is also a growing stock market presence for clean technology firms, and London's Alternative Investment Market (AIM) has become the market of choice. Over 60 firms, with a combined market capitalisation of over £4 billion, are now listed on AIM. Around half of these firms are foreign-based including some of the largest, such as Clipper Windpower (California) and carbon trader Agcert (Ireland), showing that the market hosted by the UK is highly attractive to clean technology firms worldwide.

Disclosure

Investors need, and increasingly demand, reliable information about companies' environmental impacts to be able to invest in environmental markets. This is why they have established initiatives such as the Carbon Disclosure Project (box 3.3 above). Many companies already routinely report on their environmental performance, and consider this good for business. But many others are not yet prepared to measure and disclose the environmental impacts of their activities.

CEMEP has already proposed that Government and business should work together to agree standard disclosure protocols to account for carbon and other environmental impacts. Once standards are agreed, Commissioners recommend that Government consider integrating them into corporate reporting guidance. Specifically, Government should encourage pension funds to report annually to their members on how they implement their Statements of Investment Principles (SIPs), including the extent to which they take environmental considerations into account. Charity trustees should similarly be encouraged to disclose their environmental impacts.

[22] British Venture Capital Association

To reduce the regulatory burden on companies, voluntary benchmarks for disclosure should be used where appropriate. When allied with investor influence, voluntary benchmarks can be a very powerful mechanism for promoting improved corporate environmental performance.

There are different views among CEMEP Members about whether voluntary standards alone are sufficient, or corporate reporting of environmental impacts, particularly greenhouse gas emissions, should eventually become compulsory.

Recommendation 22

To facilitate investor scrutiny of environmental markets, Government should consider integrating agreed standards of disclosure into corporate reporting guidance, and should encourage the establishment of voluntary benchmarks and consistent methods for corporate, pension fund and charity environmental disclosure.

3.4 Consumers

The green consumer

A CBI-sponsored review of the drivers that make consumers choose environmentally friendly products and services found that 'buying green' is one facet of a broader framework encompassing corporate social responsibility, ethical consumption, globalisation and fair trade[23]. Surveys show great enthusiasm for responsible purchasing, and though there is evidence of a significant gap between intentions and actual purchases, the Cooperative Bank's Ethical Purchasing Index reported about £20 billion of green and ethical purchases in 2005.

The green consumer – and the prospect of their numbers increasing in the future – undoubtedly provides businesses with part of the rationale for developing new approaches, particularly those that have a direct interface with the consumer. The food retail industry, where several of the UK's largest supermarket chains have recently announced initiatives to improve their environmental performance, is a good example. Tesco has announced that it will reduce the carbon footprint of its stores by half by 2020 and develop a commonly accepted standard carbon footprint for the products it sells. It has reduced prices for energy efficient light bulbs and other products. Marks & Spencer's 'Plan A' aims to make its UK and Irish operations carbon neutral within five years, to minimise the waste it sends to landfill by reducing and recycling packaging, and to source sustainable raw materials in a number of areas. The supermarkets are clearly confident that these initiatives make commercial sense, whether through directly increasing sales of greener products or through positive marketing impact.

The largest area of ethical spending in the UK is financial services, and there is strong potential for the development of new markets in green financial services, such as banking and insurance. Green mortgages that factor energy efficiency into payments, or link finance to energy improvements, may be stimulated by the introduction of Energy Performance Certificates. Green pensions, where a proportion of funds are invested in low-carbon technologies and all investment factors in environmental concerns, are also a possibility. The carbon emissions offsetting market has the potential to grow, and be incorporated into mainstream areas: some vehicle insurance companies are already offering offsetting into their prices, and travel insurance companies could do the same. More generally, many of the largest UK and global insurance

[23] *Buying Green*, University of Bath School of Management for CBI and RPS Group (2006)

companies, who face mounting weather-related claims as a result of climate change, are signatories to the recently-launched Climate Wise initiative. This commits them to a set of principles that includes providing products and services to consumers that help them to tackle and adapt to climate change.[24]

Barriers to green purchasing

Many other examples could be cited, from cleaning products to DIY. These developments are spurred just as much, if not more, by consumer pressure as by Government policy. However, not all businesses feel the green consumer 'pull' to the same degree and it cannot be relied upon as the sole driver for change. The £20 billion figure for green and ethical purchases represents only 2 per cent of total goods and services. Barriers to green purchasing are significant and complex, but the CBI study cites:

- lack of information on the core issues and on the competing products and services available (compounded by the proliferation of eco-labels);
- assumption that buying green is more expensive;
- belief that buying green is less convenient, as green products and services are marginal and hard to find; and
- lack of trust in companies selling green products or services.

These factors suggest that green consumption will be driven to a significant extent by marketing push rather than consumer pull. Business recognises this, as demonstrated by the recent launch of the *We're in this together* campaign, where eight major UK companies, with support from Government and NGOs, pledged to help their customers to tackle climate change by offering them "quick and easy things you can do today to help fight climate change"[25]: that is, compelling products and services that make it easier to reduce emissions. The companies involved cover a wide range of consumption, including retail, energy, banking and insurance, transport and communications.

Major changes to consumer behaviour will be hastened by providing consumers with options that clearly demonstrate improvements in convenience and cost as well as environmental impact. Once such green products and services have been introduced and shown by 'early adopters' to perform as claimed, other consumers will follow. By analogy with earlier parts of this Report, these lead markets will presage more widespread changes in consumption.

The ultimate goal is for businesses to devise products and strategies that will allow consumers to 'go green' without extra effort or expense, including in areas where consumer demand is not the main driver. They are more likely to do this in response to the incentives and signals outlined in this Report.

Smart metering

'Smart' metering of utilities has great potential to improve the engagement of consumers with their electricity, gas and water use. Smart meters allow users (both domestic and business) and suppliers to track utility use, providing information to encourage changes in behaviour and negating the need for meter readings and estimated bills. Two-way communication between users and suppliers raises the possibility of real-time recording of consumption, the introduction of dynamic demand controls and flexible tariffs to reduce discretionary and peak-demand use, and, for electricity, more accurate recording of exported electricity from micro-generation technologies.

[24] www.climatewise.org.uk; as well supporting climate awareness among customers, the principles cover: leading the way in analysing and reducing risks; incorporating climate change into investment strategies; engaging in public policy debate; and reducing the environmental impact of the signatories' own businesses.

[25] together.com

Smart metering and billing arrangements for energy and gas are currently being trialled by Ofgem, to gather UK-specific evidence of their impact on demand. They may be particularly cost-effective for small business customers. Based on positive evidence from a Carbon Trust trial of over 580 smaller businesses, Government is consulting on the roll-out of smart energy metering for business users within the next five years.

In the water sector, the majority of domestic customers remain unmetered. The Government has recently consulted on proposals to accelerate the use of metering in areas of water stress. Smart metering for water would allow the introduction of flexible tariffs, allowing price signals to be used to target households with high discretionary use. These could be adjusted in exceptional conditions such as extended drought. Smart meters can also give more accurate information on the division between leakage and consumption, where significant uncertainty exists at present.

Commissioners believe it will be important to avoid a fragmented and piecemeal approach, which would hinder the cost-effective market deployment of smart metering technology. The technology to provide smart meters is still relatively expensive. Widespread adoption will depend on the utility companies and regulators being convinced that smart meters can be cost-effective in the long-term, but without a reasonably secure future market and clarity about the required functionality, suppliers are unwilling to invest in the product development that will bring costs down.

In the water sector, CEMEP believes that a clear Government commitment to introduce flexible tariffs to influence discretionary use in areas of serious water stress, within a defined timeframe, would create a future market requirement against which suppliers could invest in product development. The scope for a 'triple smart meter' covering all three utilities, which could reduce overall costs in the long-term, should also be examined.

Recommendation 23

Policies on the introduction of smart metering should create a clear and credible market requirement against which business can invest in the cost-effective deployment of the technology. In the water sector, for example, a clear commitment to the introduction of flexible tariffs would achieve this.

Implementation

Commissioners recognise that all stakeholders have a role to play in ensuring that the UK can exploit the economic opportunities from the transition to a sustainable, low-carbon and resource-efficient economy to the full. This Report is therefore directed at all interested parties, including Government, business, investors, employees and consumers, all of whom should consider how they can contribute to its implementation.

The proposals and recommendations for Government are relevant to a variety of Departments, regulatory agencies and delivery bodies. They cannot be implemented successfully by one Department or body acting alone. The agenda must be driven forward across Government, and Government should consider whether existing structures and organisation are sufficient to achieve this.

Issues of environmental markets and economic performance cut across environmental, competitiveness and innovation policy. While it is essential for policies to achieve environmental aims and policies to stimulate innovation and competitiveness to remain distinct, environmental policy making and regulation should take into account how innovation happens, so that consideration can be given to innovation potential and positive impacts on employment and the economy. Equally, environmental considerations need to be built into the remit of innovation support mechanisms and regulatory bodies, including the independent Technology Strategy Board. Furthermore, the environmental markets agenda must be embraced by other policy areas that have a significant impact on it, such as skills, public procurement and planning.

To move towards this integrated policy approach, Government should put in place capacity-building measures to increase awareness among officials of the links between environment, competitiveness and innovation. These measures could include the provision of relevant training at the National School of Government.

Recommendation 24

All interested parties, including Government, business, investors, employees and consumers, should consider how they can contribute to the implementation of CEMEP's recommendations.

This cross-cutting agenda must be driven forward across Government, and Government should consider whether existing structures and organisation can achieve this. It should also put in place capacity-building measures, such as training at the National School of Government, to increase awareness among officials of the links between environment, competitiveness and innovation.

Annex A: Terms of Reference

1. The Commission will investigate the likely growth of global markets in environmental goods and services over the next 20 years, giving indications of possible market size, and identify the current and potential comparative advantage of UK firms in these markets, building on the economic analysis and identified opportunities of the DTI/Defra Environmental Innovations Advisory Group.
2. Within the framework of the Government's economic policies and principles of better regulation, it will make recommendations for actions by Government and business which could stimulate the growth of productivity and employment in the UK's environmental goods and services sectors and other sectors with a significant contribution to environmental outcomes and resource productivity. Recommendations should identify costs and benefits and their incidence.
3. In doing this work, the following questions should be addressed:
   - What are the key trends in world markets for environmental products and services which can generate opportunities for the UK economy?
   - Which are the key environmental sectors in which the UK has an existing and potential comparative advantage?
   - What, if anything, is holding these sectors back from achieving their full potential?
   - What kinds of environmental policy/regulatory approaches best drive innovation?
   - What other forms of public and private sector interventions best promote innovation in environmental technologies and services? Are there gaps in the current framework?
4. A broad interpretation of environmental markets should be used, encompassing all products, technologies, processes, services and systems that are more environmentally beneficial than those that they replace.
5. This is a time-limited mandate designed to provide pointers for further steps. A report should be delivered to the Government by Spring 2007.

Annex B: Membership List

David Miliband, Former Secretary of State for Environment, Food and Rural Affairs (joint Chair)

Alistair Darling, Former Secretary of State for Trade and Industry (joint Chair)

Ian Pearson, Former Minister of State for Climate Change and Environment

Malcolm Wicks, Former Minister of State for Science and Innovation

Jim Brathwaite, Chairman, South East England Development Agency

John Cridland, Deputy Director General, CBI

Tom Delay, Chief Executive, Carbon Trust

Professor David Fisk, BP/RAEng Chair in Engineering for Sustainable Development, Imperial College

Dr Jonathan Frost, Director, Johnson Matthey Fuel Cells

Julie Hill, Programmes Adviser and former Director, Green Alliance

Emma Howard Boyd, Head of Socially Responsible Investment, Director Jupiter Asset Management

Sir Peter Mason, Non-executive Chairman, Thames Water

Paul Noon, General Secretary, Prospect

Frances O'Grady, Deputy General Secretary, TUC

Professor Jim Skea, Research Director, UK Energy Research Centre

Professor John Van Reenen, Director of the Centre for Economic Performance, London School of Economics

Dr Anthony White, Chairman of Advisory, Climate Change Capital

Peter Young, Strategy Director, Enviros Consulting

Core Secretariat Team

Ann Tarran (Secretary), Defra

Adrian Hallett, BERR

Trudie Mansfield, BERR

Paul van Heyningen, Defra

Joseph McCarney was also seconded from Johnson Matthey Fuel Cells to work part time with the Secretariat.

Published by the Department for Environment, Food and Rural Affairs.

Printed on material that contains a minimum of 100% recycled fibre for uncoated paper and 75% recycled fibre for coated paper.

www.defra.gov.uk

PB12671

BERR
Department for Business Enterprise & Regulatory Reform

Department for Innovation, Universities & Skills

defra
Department for Environment Food and Rural Affairs