ice
Institution of Civil Engineers

THE STATE OF THE NATION

LOW CARBON INFRASTRUCTURE

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ABOUT ICE

The Institution of Civil Engineers (ICE) is a global membership organisation that promotes and advances civil engineering around the world.

ICE is a leading source of professional expertise in transport, water supply and treatment, flood management, waste and energy. Established in 1818, it has over 80,000 members throughout the world, including over 60,000 in the UK.

ICE's vision is to place civil engineers at the heart of society, delivering sustainable development through knowledge, skills and professional expertise.

ABOUT THIS REPORT

State of the Nation reports have been compiled each year since 2000 by panels of experts drawn from the various fields of expertise across ICE's membership.

Since 2008 ICE has published several State of the Nation reports each focused on a specific issue which will affect the delivery of effective infrastructure for the UK. ICE's reports have focused on transport, on capacity and skills and on defending critical infrastructure. These are available at ice.org.uk/stateofthenation

Their aim is to stimulate debate and to highlight the actions that we believe are needed to improve the state of the nation's infrastructure and associated services.

This report has been compiled through a process similar to that of a select committee inquiry, with a wide range of stakeholders providing evidence based on their views and knowledge of the UK's infrastructure networks.

The report is issued to a wide range of stakeholders, including politicians, civil servants, local authorities, trade, regulatory and consumer bodies, as well as the media.

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FOREWORD BY PAUL JOWITT, PRESIDENT, INSTITUTION OF CIVIL ENGINEERS

Many of the largest sources of carbon emissions are currently associated with the construction, operation, maintenance and use of infrastructure in particular in the energy, transport, water and waste sectors. Our inquiry suggests that many of the technologies and practices we need to create significant change in these sectors already exist, but their delivery is constrained by unfavourable investment and delivery conditions.

With extremely challenging and tightening CO_2 reduction targets and lengthy lead times for new and upgraded infrastructure, there is a strong justification for concerted action by government and industry. Clear statements of strategic direction, backed by a supportive policy and regulatory framework and a means of identifying and addressing failures at an early stage, are required to make progress towards emission reductions. These will create the conditions for the public and private sectors to deliver low carbon infrastructure.

Of course, the transition to a low carbon economy cannot simply be about governments and engineers. Our inquiry suggests that behaviour change, infrastructure and political action are interrelated. Changing the behaviour of people and organisations will be vital if we are to achieve the shift we need.

There is a widespread, if incomplete, awareness of the impact of carbon emissions on climate change, and many are prepared to alter behaviour to avert it. Well-designed infrastructure has begun to encourage this shift by making lower-carbon lifestyles easier to achieve. However, to reduce emissions on the scale required will take a much greater, systemic change. We need to make low carbon behaviour the norm.

Change on this level will require public support if it is not to be bogged down in legal challenge and protest. Engineers have skills in developing workable options for solving real world problems as designers, specifiers, developers and project managers. They will need to play a central role in building the public-political consensus needed in the coming decades.

Radical change is needed in the engineering profession as reducing carbon emissions becomes a key challenge for infrastructure designers and managers of multidisciplinary delivery teams.

I thank those who have contributed evidence to the inquiry from which this report is generated. The Institution of Civil Engineers is committed to provide the expertise and independent advice to government and policy makers to create the infrastructure needed for the transition to a low carbon economy.

Paul Jowitt
President,
Institution of Civil Engineers

OVERVIEW

The drive towards a low carbon society is based on three major principles:

- Avoidance of significant climate change
- Low carbon, secure energy supply
- A low carbon economy

In the short-term, a concerted effort is needed to realise quick wins through energy efficiency, demand management and the rolling out at scale of proven low carbon technologies.

In the longer-term, government and industry must use infrastructure to make low carbon behaviour as easy as possible and over time, the norm. The most obvious example is that a progressive decarbonisation of energy supply opens up the possibility of lower carbon public and private transport.

Individual pieces of low carbon infrastructure are not enough. We need to understand the carbon implications of interactions between assets and how they will be used by people and machines. This will require greater knowledge-sharing and joint working between engineering and built environment professionals of all disciplines.

THE FIRST DEADLINES FOR REDUCING EMISSIONS ARE DRAWING CLOSER AND THE LEAD TIME FOR NEW INFRASTRUCTURE DEVELOPMENT CAN BE LONG.

WHAT IS LOW CARBON INFRASTRUCTURE?

Our quality of life depends on infrastructure. There would be little economic activity without energy generation and distribution, water supply and disposal, transportation by rail, road, sea and air, and waste management.

Individual infrastructure assets are part of larger networks. These in turn are interdependent. So without energy there is no water supply, without transport there is no waste management.

The challenge for the engineer in the low carbon age is to understand and minimise the carbon emissions associated with designing, constructing, operating and maintaining this network, while still meeting society's needs.

> We need a systemic view across the entire component parts of the economy and society of how they interrelate to deliver the low carbon economy.
>
> **DR CHRIS TUPPEN, CHIEF SUSTAINABILITY OFFICER, BT**

ICE'S MAIN RECOMMENDATIONS

1

Government must create an environment in which the life-cycle carbon impact of infrastructure assets and networks is key to decision-making. The planning system, regulation, procurement, supply chain management, financing and fiscal policy should all be aligned to these goals. Financial modelling needs to change to consider the long-term impact of carbon-reducing infrastructure when assessing the viability of major infrastructure projects.

2

Infrastructure owners and clients should focus on implementing efficiency and demand management measures and create clear plans for rolling out proven low carbon technologies.

3

Engineers and other built environment professionals must develop a systems approach to managing carbon impact across the UK's interdependent energy, transport, waste and water networks. This means changing the way that engineers, clients and decision-makers think about designing and delivering infrastructure.

THE ICE INQUIRY

Between February and July 2009, ICE took verbal and written evidence from over 50 organisations involved in planning, designing, operating and maintaining the UK's infrastructure.

WE ASKED A RANGE OF QUESTIONS, INCLUDING:

- Which low carbon engineering solutions have the potential to deliver major reductions in emissions over the next 50 years?
- How can low carbon infrastructure create behaviour change?
- What legislation, regulation and market incentives are needed to deliver wholesale change?
- What are the political, social, economic and institutional barriers to delivering low carbon infrastructure and, in turn, a low carbon economy?

The inquiry's findings confirmed that infrastructure can help deliver the wholesale change in behaviour and use of resources required to reduce emissions by 80% against 1990 levels by 2050.

Contributors also stressed the need to act urgently. The first deadlines for reducing emissions are drawing closer and the lead time for new infrastructure development can be long.

When it came to the actions required from government, industry and the engineering profession to help deliver low carbon infrastructure, our inquiry identified a degree of consensus. There is widespread support for immediate action to reduce demand, maximise efficiency and develop a systems approach to reducing emissions across infrastructure networks.

While our inquiry has identified a wide range of technologies that are viable and could be rolled out at the scale required, views on priorities differ widely. Contributors acknowledged that building public support for the changes required will be a major and essential challenge.

In this context the engineering profession has the skills to develop practical solutions to real-world problems. It will need to take an active role in developing a public and political consensus on how the UK's infrastructure should look in 2050 and the action needed to realise this vision.

SUMMARY OF RECENT UK GOVERNMENT ACTIVITY

The UK government has recently published a series of low carbon strategy documents in advance of the UN Climate Change Conference in Copenhagen in December 2009.

THE UK LOW CARBON TRANSITION PLAN

The UK Low Carbon Transition Plan[1] sets out how the UK should reduce its emissions by 34% on 1990 levels by 2020.

Specifically, the plan sets out the government's intention to generate 40% of the UK's electricity from low carbon sources – with around 30% coming from renewables – and to facilitate the construction of the next generation of nuclear power stations.

THE RENEWABLE ENERGY STRATEGY

The Renewable Energy Strategy[2] sets out how the government intends to meet the requirement under the Renewable Energy Directive to source 15% of the UK's energy (electricity, heat and transport) from renewable sources by 2020.

LOW CARBON TRANSPORT – A GREENER FUTURE

The Low Carbon Transport[3] document outlines how to reduce emissions from domestic transport by 14% over the next decade using a range of possible options, including technology, alternative fuels, trading and behavioural changes.

In addition to the above documents, by spring 2010 the government intends to work with industry and others to publish a strategic roadmap, looking at how to continue progress up to 2050.

THE LOW CARBON INDUSTRIAL STRATEGY

The Low Carbon Industrial Strategy[4] outlines how the government plans to support the development of the UK's low carbon technologies and services sector by targeting key industries and regions where the UK enjoys competitive or commercial advantage, including offshore wind, marine power and carbon capture and storage.

LOW CARBON REVIEW OF THE CONSTRUCTION INDUSTRY

The review, announced on 18 September 2009, will assess the strengths of and opportunities for the UK construction industry in a low carbon economy and consider how the UK can be a world leader in the sector.

1 Department of Energy and Climate Change (2009) The UK Low Carbon Transition Plan: National Strategy for Climate Change. TSO, London
2 Department of Energy and Climate Change (2009) The UK Renewable Energy Strategy. TSO, London
3 Department for Transport (2009) Low Carbon Transport: A Greener Future – A Carbon Reduction Strategy for Transport. TSO, London
4 Department of Energy and Climate Change (2009) The Low Carbon Industrial Strategy. TSO, London

MAKING LOW CARBON BEHAVIOUR THE NORM

To deliver significant cuts in carbon emissions, radical changes in society and behaviour are required. To create this change, we need to develop the infrastructure which underpins our daily lives and economic activity so that the only choices we make are low carbon ones.

Infrastructure is designed to meet demand from individuals, homes, industry and transport.

Reducing demand and increasing efficiency will directly reduce the need for infrastructure and thereby its carbon content and the emissions generated by its use.

Measures that encourage conscious choices by users can help manage demand. Smart metering for water and power will give consumers the information they need to use resources more efficiently. This can deliver wide benefits. For example, in the energy sector, transmission losses between the power plant and the user mean that demand reductions at the point of use lead to even greater reductions in fuel use and CO_2 emissions at the point of generation.

However over time low carbon behaviour and infrastructure must cease to be a choice and become the norm.

Our evidence suggests that this kind of systemic change requires firm government intervention, backed by new and upgraded infrastructure. An example where this approach has worked is the waste management sector, where a combination of clear targets, Landfill Tax and threats of fines for local authorities has slowed the growth of waste and increased recycling and reuse. This change is underpinned by new infrastructure to sort, recover, reprocess and extract energy from waste. (See Landfill Tax case study opposite).

The low carbon world will require more changes like this. For example, transport infrastructure is driven by demand for travel and this is increasing. Public transport with lower-carbon power sources must play a greater role in moving people and goods around the UK. But demand management measures such as workplace parking limits and road user charging will be required to make using public transport the norm. Small changes can be made by reducing the need to travel by means such as the integration of homes and jobs, remote working and video-conferencing.

However, major change requires major shifts in spatial planning and social norms. If even half of private car trips switch to public transport, the existing infrastructure would fail, highlighting the need to invest in low carbon forms of public transport now.

The provision of efficient surface transport systems as an alternative to short haul domestic air travel will only lead to behavioural change if financial measures such as increased air tax are in place to encourage use of the alternatives.

Change on this scale will be controversial. Government and the engineering profession will need to be open and honest about the downsides, including (in some areas) the reduction in personal choice. If the low carbon transition is not to be beset by legal challenge and protest, public and political consensus will need to be created. At the heart of any such consensus is a proper understanding, by all those involved, of the realistic options for achieving our goals.

Developing deliverable options for real world problems is a core engineering skill. So it is vital that the engineering profession places itself at the heart of the political process and wider public debate.

OVER TIME, LOW CARBON BEHAVIOUR AND INFRASTRUCTURE MUST CEASE TO BE A CHOICE AND BECOME THE NORM

LOW CARBON BEHAVIOUR CASE STUDY: LANDFILL TAX

The Landfill Tax has changed behaviour by encouraging waste producers to produce less waste and divert valuable material from landfill into recycling, composting, energy from waste and more environmentally friendly methods of waste disposal

The tax puts a cost on the environmental impact of landfilling waste, not least methane emissions, which is an even more potent greenhouse gas than CO_2. It is paid on top of normal landfill or 'gate' fees by businesses and local authorities that want to dispose of waste using a landfill site.

There are two rates of tax:

- A standard rate for wastes which decay, such as household wastes. This is currently £40 per tonne and is set to increase by £8 per tonne each year until at least 2013
- A lower rate for inactive and inert wastes such as rocks and soil – currently £2.50 per tonne

Waste reduction has been relatively successful now that tax levels have risen above £35 per tonne and further rises will be more effective at creating drastic changes. At landfill sites registered for the tax, overall quantities of waste recorded fell by 25% from around 96 million tonnes in 1997-98 to around 72 million tonnes in 2005-06[1].

As landfill tax rates have risen, waste companies and technology providers are building systems to deliver renewable energy and supply alternative disposal routes to landfill.

The tax reflects the significant impact that landfill has on the environment. By ensuring that waste producers incorporate the full cost of waste disposal into business decisions, landfill tax encourages the development of sustainable waste management options, including recycling and advanced thermal treatment with energy recovery.

> If we are serious about 80% by 2050, we are going to have to make some radical changes to behaviour now...One of the best ways of cutting carbon out of the economy is to reduce…consumption rather than trying to increase efficiency.
>
> **PETER GUTHRIE OBE, PROFESSOR IN ENGINEERING FOR SUSTAINABLE DEVELOPMENT, UNIVERSITY OF CAMBRIDGE**

1 Department for Business, Innovation and Skills (2009) BIS Economics Paper No.1: Towards a Low Carbon Economy – Economic Analysis and Evidence for a Low Carbon Industrial Strategy

INFRASTRUCTURE UK...IS WELL-PLACED TO PROMOTE A SYSTEMS APPROACH TO THE DEVELOPMENT OF OUR INFRASTRUCTURE NETWORKS

TRANSFORMING INFRASTRUCTURE

In addition to the greater public role outlined above, the engineering profession and the industries it serves must fully adapt to a low carbon agenda. Those involved in commissioning, designing, procuring or constructing infrastructure will need to make changes in the way they go about their business. **Three key challenges are:**

1. MAKING CARBON A KEY DESIGN CONSTRAINT

The engineering design process involves identifying constraints such as cost, material availability and health and safety. We must ensure that mainstream engineering design embraces life cycle carbon as a key constraint and an early factor in the decision making process for design choice. Decisions must account for consequential carbon – the carbon used and emitted in the use of this infrastructure.

ICE is committed to taking a lead on developing design methodologies, materials selection techniques, and procurement tools to drive this change, and will work with relevant bodies to achieve this.

2. DEVELOPING A SYSTEMS APPROACH

Individual pieces of low carbon infrastructure are not enough. Engineers, utilities, operators and investors need to understand the carbon implications of the interactions between infrastructure assets, people and machines. Only in this way will we be able to manage emissions across whole networks. This systems approach will require greater knowledge-sharing and joint working between engineering and built environment professionals of all disciplines.

Government has committed to create a new body, Infrastructure UK, to identify the UK's long-term needs and help ensure they are met. This body is well-placed to promote a systems approach to the development of our infrastructure networks.

3. DEVELOPING STANDARD MODELS FOR COUNTING CARBON

The first two measures will be more effective with accepted standard models for measuring life-cycle carbon impact. The engineering profession must take its share of responsibility for these changes but cannot act alone. Clients need to drive low carbon practice. Public procurement, which accounts for more than half of the UK's infrastructure spending, has a central role to play. For example, the Highways Agency, Transport Scotland, and others are developing carbon-counting tools for highways construction and maintenance.

ICE is committed to working with partners to develop standardised carbon-counting methodologies to drive this change and leading the debate on the carbon price needed to effect major change and investment.

TRANSFORMING INFRASTRUCTURE CASE STUDY: TRANSPORT SCOTLAND CARBON MANAGEMENT SYSTEM

Transport Scotland has been developing a carbon calculator tool, part of a Carbon Management System (CMS).

The CMS is intended to provide Transport Scotland and its supply chain with a transparent and user-friendly carbon calculator. The tool uses information on quantities of energy, fuel and materials used in different processes and projects, and converts them to estimates of carbon emissions.

It has been developed based on international protocols for carbon emissions and uses the latest available emissions factors.

The tool is being developed with additional functionality to provide a 'carbon efficiency tool' for projects. This will allow the CMS to be deployed throughout the life of projects as a means of providing information about carbon emissions with the aim of minimising them across the life of the asset.

Transport Scotland hopes the CMS will provide:

- Better information on energy use and carbon emissions
- A clear understanding of the energy and material flows through transport infrastructure projects and identification of opportunities for greater resource efficiencies and value for money on a whole life cost basis
- An understanding and systematic management of Transport Scotland's carbon footprint year on year
- A tool to provide management information and a way of driving reductions in carbon emissions, delivering more sustainable growth
- An industry leading and accepted carbon calculator which can be reliably and consistently used by Transport Scotland's suppliers and stakeholders

Transport Scotland is currently piloting their CMS on selected projects and is expecting to provide some initial indications of the relative proportions of the carbon footprint across some project types.

LOW CARBON INFRASTRUCTURE SOLUTIONS

Our inquiry has identified a wide range of infrastructure solutions that could be delivered at the scale required in the short, medium and long-term. It was clear that in many areas of infrastructure development, the UK lacks public, political and professional consensus on relative priorities and their effectiveness in abating emissions.

There is also ongoing debate, particularly in the energy sector, about the best balance between larger, centralised infrastructure and smaller, decentralised solutions.

Our evidence also highlighted many instances where, to be fully effective, infrastructure solutions need to be accompanied by changes in areas such as policy, technology, finance and demand management.

A summary of infrastructure options in the short, medium and long-term is set out on these pages. Longer summaries of evidence submitted to ICE are available at www.ice.org.uk/stateofthenation

IN ADDITION, WE IDENTIFIED FOUR OVERARCHING FINDINGS:

- Across all infrastructure networks increased efficiency is vital. This should encompass demand management via measures such as water metering or road user charging. Efficiency improvements on both the supply and demand sides will also be required, for example by increasing heat capture from electricity generation and thermal treatment of waste.
- Many of the low carbon technologies we need to substantially reduce our CO_2 emissions already exist but are being constrained by unfavourable conditions for their delivery. So although research and development into new technologies will be vital to reduce emissions by 80% by 2050, for at least the next decade the UK must make a concerted effort to roll out known technologies that are commercially viable at scale.
- Technologies which appear expensive today need not be so over the longer-term, if foreseeable increases in the cost of carbon emissions and their wider economic benefit are taken into account.
- Carbon abatement on a standard measure must become a key determinant of the appraisal of infrastructure options.

SHORT-TERM

Onshore and offshore wind can and must be implemented now. These solutions are more advanced and cost-effective than others. But full implementation of the Planning Act 2008 reforms must take place as soon as possible to speed up the delivery of essential additional wind farms to ensure the UK hits its renewable energy targets by 2020.

The energy grid must be upgraded with additional transmission capacity to support large new renewables not served by the current grid. The feed-in-tariff and connection of available micro-generation solutions, such as solar panels and micro-wind turbines, should be introduced. Power needs to be able to flow from the grid to households and vice-versa to support individual energy production.

A supergrid across Europe is already being developed by some countries. There needs to be cross-border legal and technical agreements to expand these early initiatives across Europe and beyond to provide increased balancing of electricity demand and supply as well as access to lower carbon sources.

In some locations combined heat and power (CHP) plants ensure maximum efficiency from electricity generation by capturing and using waste heat. The most efficient method of heat capture is decentralised CHP and district heating because the heat only has a short distance to travel, thus reducing transmission loss. With many thermal power stations nearing the end of their life, there is an opportunity now to build new CHP plants, downsize and relocate existing power plants and create district heating networks.

Electrification of the rail network would reduce the carbon impact of our railways by eliminating diesel engines. Electric trains emit 20-35% less carbon than diesel locomotives[1]. For rail electrification to achieve its potential, full decarbonisation of the electricity generation sector must start as soon as possible.

1 Department of Energy and Climate Change (2009) The UK Low Carbon Transition Plan: National Strategy for Climate Change. TSO, London

MEDIUM-TERM

Some infrastructure will take time to reach planning consent (eg nuclear), secure finance (eg tidal barrages) and be technologically proven (eg carbon capture and storage).

The next generation of nuclear power stations will provide a vital long-term, secure and low carbon source of baseload power. The government must remove regulatory barriers and provide long-term certainty.

Carbon capture and storage (CCS) has the potential to keep the UK and the world's abundant supply of coal in the energy mix. But we need financial, regulatory, and legislative changes — along with successful demonstration — before it can be implemented on a commercial scale.

Wave and tidal power have significant potential in the UK, but are at an early stage of development. There have been some operational applications in other parts of the world, in Norway, Australia and France. But they are still relatively expensive, are yet to be fully commercialised at scale and do not operate for extended periods to establish performances and rates of return on investments. Greater investment and technological development is needed in the short-term. The proposed Severn Tidal Power Scheme could provide up to 5% of total UK electricity generation[1]. Current accounting practice makes this scheme appear expensive. Yet at different discount rates which allow for the power to be generated over 100 years to be considered, the cost becomes very low.

Heat pumps have great potential to reduce emissions from heat production, since the net carbon emissions of heat pumps are lower than gas fired boilers. Government can help lower their relatively high purchase costs and expand the UK's manufacturing capacity to allow widespread use of heat pumps to become a reality.

Plants that produce energy from waste can unlock the value hidden in the waste we cannot recycle or reuse. An ICE-commissioned study in 2005 showed that energy from residual waste could contribute around 10% of the UK's energy demand[2]. There are lingering barriers within the planning process and securing acceptance of the need for energy from waste plants must be resolved to allow biomass to contribute its full potential.

Conventional electric or high-speed rail can provide a significantly lower-carbon alternative to short-haul and domestic flights. It could also reduce the number of car journeys between urban areas. Government support, passage through the cumbersome planning process and the right financial mechanisms are all essential if high-speed rail is to play its part in a low carbon economy.

Assuming lower carbon vehicles become the norm, a charging grid for the whole country will be needed in the medium and longer-term. But similar to the electrification of the rail network, full decarbonisation of the electricity generation sector must commence for a charging grid to contribute its full potential.

LONG-TERM

In the longer-term, large-scale solar farms and technologies such as nuclear fusion have the potential to provide a sustainable long-term solution to the world's need for secure base-load electricity – offering abundant, low cost, zero emission and low waste energy.

For instance, at present fusion remains a laboratory technology because the amount of energy required to put into fusion outweighs the yield. Further research, financial and government support must be continued in the short and medium-terms. Equally, engagement between fusions scientists and the engineering community is essential now so that fusion can advance from simply being a scientific development to an infrastructure reality.

1 Department of Energy and Climate Change (2009) The UK Low carbon Transition Plan: National Strategy for Climate Change. TSO, London.
2 ICE (2005) Quantification of the Potential Energy from Residuals (EfR) in the UK. Institution of Civil Engineers, London.

> No nation can move in isolation on carbon price because there is embedded carbon in everything. It would crucify us competitively. All it will do is put national prices up and make people poorer. It needs international cooperation to agree on a high price which is why it is such a huge challenge for mankind.
>
> **PETER T JONES OBE, ADVISOR ON WASTE, CARBON AND MATERIALS EFFICIENCY**

CREATING THE CONDITIONS FOR ACTION

Moving to low carbon infrastructure will require changes to the environment in which clients, owners and engineers operate. We must establish a stable, long-term framework that reduces risk for investors, manufacturers, the construction industry and other stakeholders.

While this chapter focuses on government's role, the engineering profession and its representative bodies need to play their part. This should include reforming key industry tools such as procurement methodologies, design guides, contracts and environmental assessment schemes.

GOVERNMENT – STRATEGIC LEVEL ACTIONS

Carbon price

To deliver investment in key technologies we need a realistic and long-term carbon pricing mechanism with a guaranteed floor. This could be achieved by either a carbon tax or government commitment to maintain prices within the European Union Emissions Trading System (EU ETS). A current criticism of the system is that EU government issues free 'permits to pollute' which undermines low carbon planning and this should be resolved urgently.

Standard carbon measure and counting standards

Different methods for measuring and counting carbon are springing up in each infrastructure sector. A common UK system will save time, increase comparability and allow carbon measures to be used in decision-making. Once a workable common system is in place, it can be refined to deliver optimum outcomes.

The government can help by establishing a standard methodology for carbon counting. This could be applied throughout government asset procurement and maintenance contracts and become a de-facto British Standard as soon as possible.

Reduce risk in the planning system

The process for securing planning approval for major infrastructure deters investment because of its length, uncertainty and cost. The new regime put in place by the Planning Act 2008 has the potential to improve this situation. It establishes the need for infrastructure via a series of national policy statements (NPSs) and has created an Infrastructure Planning Commission (IPC) to adjudicate on applications within a fixed timescale.

NPSs will be owned by ministers, who will need to demonstrate how the policies contained within the statements contribute to climate change goals. This will provide further clarity and ICE strongly supports the full implementation of this new system. But the IPC and NPS systems only apply to larger projects of national significance. The lower tiers of planning down to local authority level should also put a low carbon agenda at the heart of all development decisions.

Stable and coherent policy – Infrastructure UK

Government has introduced a range of measures to support low carbon technologies, such as the Renewables Obligation and, from 2010, feed-in tariffs for micro-generation. It has also created new bodies to drive delivery of nuclear, renewables and carbon capture and storage. Finally, in July 2009 it published an extensive Low Carbon Transition Plan with a promise that a "road-map" to 2050 will follow in spring 2010.

This activity in overlapping policies needs to be coordinated and its impact monitored. More importantly, there needs to be a focal point for triggering remedial action if policies are not working. Infrastructure UK, the new body being developed by HM Treasury and the Department for Business, Innovation and Skills, should take on this role.

Funding – National Infrastructure Investment Bank

All of the above measures will be useless unless adequate funding at affordable rates is available for new and upgraded infrastructure. Under current conditions there are real concerns that this will not be the case – 2009 has seen many projects struggle to find capital at affordable rates, if at all. Although the government has created the Treasury Infrastructure Finance Unit (TIFU) to ensure PFI projects are able to access capital, at the time of writing little has been done to address the cost of capital. ICE believes that Infrastructure UK needs to be complemented by a mechanism, such as a National Infrastructure Investment Bank, to fill this gap and provide secure long-term funding at competitive rates of interest to major national projects.

GOVERNMENT – OPERATIONAL LEVEL

Regulatory reform

The remit of the Office of Gas and Electricity Markets (Ofgem), the Water Services Regulation Authority (Ofwat), and all relevant transport and waste regulators should include the regulation of carbon emissions associated with individual infrastructure assets and the operation of the network as a whole. The current regulatory remit is too focused on short-term consumer price and carbon performance suffers as a result. The regulatory remit must be expanded so the reduction of carbon is a fundamental driver in determining both infrastructure investment and consumer price.

Making counting carbon count – planning and procurement

Measuring the carbon impact of infrastructure is not enough; government must drive decision-making. It must take a lead and ensure public procurement and strategic planning is driven by the need to reduce carbon emissions. At a local authority level, councillors and council officials must accept their responsibility for implementing these national imperatives for low carbon development. Important planning policies such as local development frameworks must encourage and require designers and developers to deliver low carbon solutions.

> “Regulators, government and the renewables sector need to work more closely together to ensure development and application of best practice industry standards and methods of working. This would help ensure that planning delays due to environmental requirements were minimised.
>
> **SCOTTISH ENVIRONMENTAL PROTECTION AGENCY**

ICE RECOMMENDATIONS

Moving the UK to a low carbon economy requires:

- Rapid shift of energy supply to low carbon sources
- Electrification of transport
- Reduced demand for energy, transport, water and waste management facilities

While all these challenges are technically achievable, the scale of the challenge requires the full commitment and action from government, industry and the engineering profession.

GOVERNMENT AS POLICY MAKER SHOULD:

- Task Infrastructure UK with promoting a systems approach to managing carbon across infrastructure networks and co-ordinating low carbon policy across relevant government departments
- Task Infrastructure UK with monitoring progress of implementation of relevant aspects of the low carbon transition plan and triggering remedial action where necessary
- Facilitate the creation of a common methodology for accounting for the life-cycle carbon footprint of infrastructure
- Signal that it will guarantee a minimum (floor) price of carbon in the medium to long-term
- Press for reform in the EU ETS for realistic pricing of carbon for all emissions
- Fully implement the Planning Act 2008 to speed up the process for delivering low carbon infrastructure
- Ensure Local Development Frameworks and Supplementary Planning Guidance enable the creation of low carbon infrastructure at the local level
- Create a National Infrastructure Investment Bank (NIIB) to ensure that sufficient capital is available at affordable rates
- Expand the role of regulators so the reduction of carbon is a fundamental driver in determining both infrastructure investment and consumer price

INFRASTRUCTURE OWNERS/ CLIENTS (INCLUDING GOVERNMENT AS CLIENT) SHOULD:

- Prioritise energy efficiency and demand management measures
- In the short-term (five to 10 years) focus on rolling out known technologies at scale
- Establish carbon abatement as a key determinant in procurement procedures and options appraisal for new infrastructure projects

THE ENGINEERING PROFESSION SHOULD:

- Develop methodologies and skills for managing carbon across infrastructure systems
- Develop methodologies and skills to ensure carbon is a key design constraint
- Lead debate on detailed priority actions and technologies for decarbonising infrastructure networks
- Lead debate on trade offs and constraints on choice that may be required to maximise emission reductions

> If you have an 80% decarbonisation target, clearly you are not going to hit that target unless you significantly decarbonise heat, transport and electricity. We think you should be progressing action in three sectors in parallel rather than waiting to decarbonise one as a whole.
>
> **EDF ENERGY**

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