

Low carbon project design

In the absence of any agreed national guidance, a significant number of civil engineering companies have developed or are starting to develop carbon tools. Although many in the sustainability community are wary about the results of a narrow focus on the carbon agenda, the reality is that the UK climate change legislation has imposed a tight timetable for an 80% reduction of carbon omissions to 2050; hence we need tools to help us to understand possible actions and progress better.



A selection of projects that represent those that are or need lower-carbon performance (photos by Roger Venables).

On 23 November, ICE published its report on low carbon trajectories to 2050. Produced by a Steering Group chaired by Tim Chapman of Arup as part of a Presidential Commitment by Peter Hansford a year ago, the report recommends a number of commitments for ICE, and a number of priorities for government and society. These are:

Priority 1: Establish a shared understanding of the purpose and performance requirements of UK infrastructure

Infrastructure exists to meet the economic, social and environmental needs of the nation. In practice this means that minimising carbon emissions associated with infrastructure is likely to require trade-offs between many potentially conflicting objectives. To make such decisions in a consistent and rational way will require a widely shared understanding of the purpose and performance requirements for our national infrastructure.

The UK Government, through the National Infrastructure Plan, should set out the future requirements for each aspect of infrastructure expressed as output-based performance requirements. This will need to include level of service to be provided, accessibility, reliability and resilience, alongside carbon emission targets and other aspects of sustainability. These performance requirements should be reported on through a *National Infrastructure Scorecard* that also includes measures of the adequacy of investment plans and the health of the underpinning skills and research base.

Priority 2: Establish an effective, transparent and predictable carbon price as the centre piece of a package of incentives for developing low carbon infrastructure

Carbon emissions are a classic example of negative externalities resulting from market failure. An effective and stable carbon price should be a potent mechanism for addressing this failure and will encourage asset owners to invest in low-carbon technologies and other measures. It will also encourage users of infrastructure to make the necessary changes to their behaviour.

The UK Government is felt by ICE to be right to commit to setting a carbon floor price. This should form the centre piece of a package of incentives to encourage investment in low-carbon infrastructure and changed behaviour by its users.



Priority 3: Systematically apply the concepts of Capital Carbon and Operational Carbon to infrastructure decision making

Carbon emissions are associated with each stage of the infrastructure life cycle: design; construction; maintenance; usage; dismantling and/or refurbishment. Capital Carbon (CapCarb) is the carbon expended in creating an asset and where Operational Carbon (OpCarb) comprises carbon emissions from all aspects of operation and usage of items of infrastructure. Often, options that are more-carbon-intensive in the construction phase allow for significantly reduced emissions during use or the operational phase. Engineers must be engaged in projects at the inception stage and must contribute to the task of balancing Capital and Operational Carbon to minimise whole life emissions.

In a break from much current practice, these assessments must include the carbon arising from the use of infrastructure, such as vehicles on road or rails, and must take a system-wide view of the impact of individual projects on the performance of networks.

A concerted research effort is needed to create usable inventories of carbon emissions for all stages of asset life in each network. Government should also identify the most effective way of ensuring that all public and regulated infrastructure owners consider the

CapCarb and OpCarb of their assets in their strategic investment plans.

Priority 4: Establish a high level evaluation methodology for use at the appraisal stage of infrastructure projects

The greatest carbon savings in an infrastructure project can be made at the appraisal stage by selecting the best strategic option before detailed design and construction begin. This is therefore the crucial point for balancing capital and operational carbon, whilst still meeting the fundamental objectives of the scheme. Prevalent industry practice tends to seek carbon savings at later stages in projects when the most radical options to reduce carbon are no longer possible.

An industry effort is required to develop a high-level evaluation methodology for use at the appraisal stage of projects. This will enable investment decisions to be made in full knowledge of the whole-life carbon impacts of options.

Priority 5: Make greater use of demand management

A number of elements of UK infrastructure are under considerable stress from very high usage levels, leading to high levels of congestion at periods of peak demand. This creates additional carbon emissions in those networks and reduces the social and economic value of that infrastructure. "Predict and Provide" would lead to higher emissions through unnecessary new build, often just to cover isolated peaks of extreme demand, and may in itself create additional demand, leading to further congestion.

If infrastructure is to meet performance requirements and deliver its full range of benefits to society, ICE's low-carbon steering group believe that greater use must be made of a variety of measures to manage demand for infrastructure services.

ICE will engage with all stakeholders to address the adequacy of the UK research effort into low carbon infrastructure and identify, and promote future needs to enable universities and research funding bodies to coordinate their efforts into a concerted programme to improve the carbon efficiency of infrastructure.

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