



**THE
STATE
OF THE
NATION**

**INFRASTRUCTURE
2010**



THE STATE OF THE NATION: INFRASTRUCTURE 2010

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 risk management, waste and resource management 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. 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.

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. 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. Since 2008 ICE has published reports focused on defending critical infrastructure, low carbon infrastructure, transport and capacity and skills. These are available at ice.org.uk/stateofthenation

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THE GRADES

A

FIT FOR THE FUTURE

Infrastructure is well-maintained and in good condition. There is excess capacity to cope with major incidents. There is clear strategic leadership with good plans to develop the sector to meet the needs of the next five years.

B

ADEQUATE FOR NOW

Infrastructure is in acceptable condition with a reasonable maintenance regime. It can meet current demand and deal with minor incidents across the network. However, investment will be needed to meet needs in the next five years.

C

REQUIRES ATTENTION

Infrastructure is infrequently maintained and requires attention. There is no excess capacity resulting in deficiencies at peak periods and if there are even minor incidents. Significant investment is required to improve it to meet needs in the next five years.

D

AT RISK

Infrastructure condition is below standard and poorly maintained. There is frequently a lack of capacity to meet demand and it is not resilient. In the absence of significant investment there may be an impact on the national economy.

E

UNFIT FOR PURPOSE

Infrastructure is in unacceptable condition with little maintenance. There is insufficient capacity and resilience is of serious concern. The state of the infrastructure is impacting on the national economy.



WELCOME TO THE STATE OF THE NATION REPORT ON INFRASTRUCTURE 2010

◀◀ What is the state of our infrastructure?
Is our infrastructure being taken for
granted? Is the UK falling behind its global
competitors? And is society being put at risk?



Infrastructure is vital to our way of life. It is vital to society. It is vital to economic growth in an increasingly competitive world. It is vital

to the environment. And it is vital to the very existence of a civilised society.

If we don't invest in critical infrastructure now, we will face severe consequences in the future. We must revive our infrastructure to make it fit for the 21st century, and not remain dependent on ageing assets.

But in the wake of a financial crisis and now with a new government, how do we ensure that the nation's infrastructure receives the investment it deserves?

This State of the Nation report is produced by one of the world's most senior and respected professional engineering institutions. The Institution of Civil Engineers (ICE) exists to serve society by developing the knowledge, skills and advice to provide the right infrastructure. It also offers independent opinion on the actions we should take.

The report is an evidenced-based assessment of the nation's energy, transport, water, flood and waste sectors. Here we consider the condition and capacity of our infrastructure networks, their resilience, their sustainability and their inter-dependence, and how the UK can fund the major investment required.

Most of all, we highlight the importance of a long-term vision for our infrastructure. ICE welcomes the establishment of Infrastructure UK (I-UK), the government body tasked with developing a 5 to 50 year view of our strategic infrastructure priorities and establishing a clear delivery plan.

ICE will support and inform the work of I-UK, which needs strong backing from the new government if it is to make the right decisions to meet the urgent challenges set out in this report.

Paul Jowitt
President,
Institution of Civil Engineers

Acknowledgements

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THE STATE OF THE NATION: SUMMARY



ENERGY

STRATEGIC TRANSPORT NETWORKS

LOCAL TRANSPORT

GRADE

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GRADE

B

GRADE

D

KEY RECOMMENDATIONS:

- Take urgent decisions on nuclear power, renewable energy and carbon capture & storage for coal fired power stations
- Deliver existing energy strategies and future National Policy Statements to create a delivery plan that sets out:
 - 1) clear timelines for government action
 - 2) a programme of active engagement with asset owners, infrastructure suppliers and financiers
- Retrofit our current building stock to make it energy efficient

KEY RECOMMENDATIONS:

- Enable the construction of new high-speed rail routes and provide investment in our existing railway network to increase capacity, maintain reliability and reduce journey times
- Tackle chronic highway congestion and improve resilience by using managed motorways, and investing in widening and junction improvements to increase capacity at pinch-points
- Introduce road user charging or some other form of demand management to manage our limited road space

KEY RECOMMENDATIONS:

- Improve the condition of the local road network through good asset management and adequate funding
- Provide alternatives to private car use by integrating local public transport modes and improving connections to the national network
- Manage the demand for private car journeys and encourage a shift to more sustainable modes

THE GRADES:

A FIT FOR THE FUTURE

B ADEQUATE FOR NOW

C REQUIRES ATTENTION

D AT RISK

E UNFIT FOR PURPOSE



WATER AND WASTEWATER

GRADE

B

FLOOD RISK MANAGEMENT

GRADE

C

WASTE AND RESOURCE MANAGEMENT

GRADE

C

KEY RECOMMENDATIONS:

- Reform the regulatory regime to drive the long-term investments necessary to address climate change, population growth and overall water infrastructure sustainability and avoid stop-start investment
- Reduce demand for drinking water by changing the pricing structure, reducing leaks and using low-flow fixtures, supported by water metering
- Reduce the volume of water treated at wastewater works by separating flows of sewage and surface water

KEY RECOMMENDATIONS:

- Improve efficiency through long-term planning, collaborative working and setting performance targets for flood infrastructure
- Improve community engagement to agree realistic expectations about flood risk. Highlight the opportunities available for people and communities to reduce flood risk and improve resilience
- Increase the use of adaptive natural drainage systems such as sustainable urban drainage systems

KEY RECOMMENDATIONS:

- Develop a national resource management infrastructure plan to drive the delivery of facilities required to meet waste management, energy, materials and climate change policy goals
- Reduce waste by designing it out at source
- Improve the integration of the management of municipal and commercial & industrial waste



OVERVIEW

Infrastructure is vital to our nation. It is a complex and interdependent system which provides us with the energy, transport, water and other essentials that are the basis of our civilised society and our economic well-being.

This complex system of infrastructure is fragile and affects our nation's resilience, as has been demonstrated in recent times by the impact of flooding, the severe winter and volcanic ash.

In the last generation we have grown more and more reliant on our infrastructure. Both the OECD and HM Treasury have acknowledged infrastructure investment has a positive effect on economic growth.¹

That is why this independent assessment of the state of our nation's infrastructure is so important.

Not only do we investigate the condition, capacity, resilience and funding of the various components of our infrastructure, but we also found other issues have a dramatic effect on all infrastructure sectors. The sustainability of infrastructure affects its ability to drive a low carbon economy. And recurring problems with funding, skills and regulation hinder the delivery and performance of infrastructure.

This then is the overview of ICE's assessment of the State of the Nation's infrastructure in 2010. In making this judgement we act not for ourselves, but for the public good.

The nation that neglects its infrastructure neglects its future. But the nation that respects its infrastructure respects its people, and provides for their sustainable future.



- ICE is extremely concerned about the state of **energy** infrastructure, which puts at risk the well-being of our nation. Urgent action is needed to address both security of supply and the carbon emissions from generating electricity and heat. Investment is needed now to plug an energy gap which may be with us in less than five years and to meet very demanding emission reduction targets.
- On **transport** we find that long-distance infrastructure links between major towns and cities, such as railways and motorways, are generally in good condition. We are encouraged by plans to construct new high-speed rail lines, which will provide much needed additional transport capacity. It is essential to manage our limited road space through the introduction of road user charging or some other form of demand management. By contrast, **local transport** is poor. There is an immense backlog of local road maintenance work and there is poor integration of public transport services, which would help make public transport more attractive.
- The nation's **water** infrastructure is serving its customers well, thanks to 20 years of regulatory-driven investment. However, the lack of resilience demonstrated by recent droughts and floods will only increase as climate change takes hold. And without major reductions in demand, the nation's water infrastructure will not meet the government's long-term targets for carbon emissions.
- For the duration of the current parliament continued investment in **flood risk management** is essential to avoid extensive flooding. But in the long-term, our approach to flood risk management must change - we need a sustainable vision which accepts some changes in our shoreline and climate.
- We need to reduce the amount of **waste** we send to landfill, not least to avoid significant infraction fines from the EU. But our entire approach to waste must change. Instead of managing waste on the basis of its source, we should manage it according to the materials it contains – such as glass, paper, and plastics. Waste infrastructure should support the circular movement of materials around our economy. And the waste industry should focus on becoming a supplier of high-quality materials for manufacturers, compost for agriculture and fuel for energy generation.
- We must develop our infrastructure **sustainably** to reduce emissions, address climate change and support the move towards a low carbon economy. Behavioural change will be needed as we manage demand and balance that with supply and resilience.
- Infrastructure investment in the UK is expected to increase significantly until 2030 and possibly beyond.² This necessary investment is undeniably difficult during the economic downturn, but we need to plan now to **fund and deliver** the infrastructure needed in future.
- We desperately need to avoid the stop-start investment caused by short-term government funding horizons and **regulatory cycles**. To leverage in further investment from the private sector, new forms of funding are required, like a National Infrastructure Investment Bank. But increased levels of investment must also be accompanied by good asset management and demand management. That is why ICE commends the establishment of Infrastructure UK and its **longer term strategic planning**. ICE will support and inform the work of I-UK, which needs strong backing from the new government if it is to make the right decisions to meet the urgent challenges set out in this report.
- Without long-term planning we will not be able to provide the **capacity and skills** needed to deliver and operate our infrastructure. The recovery may well see the severe skills shortages experienced in the middle of the last decade, unless we can give the industry confidence to invest in its professionals. It is civil engineers and other professionals who will deliver the infrastructure that our nation needs.

1. Going for Growth, OECD, 2009 & Strategy for national infrastructure, Infrastructure UK, HM Treasury 2010.
 2. Strategy for national infrastructure. Infrastructure UK, HM Treasury 2010.

GRADE

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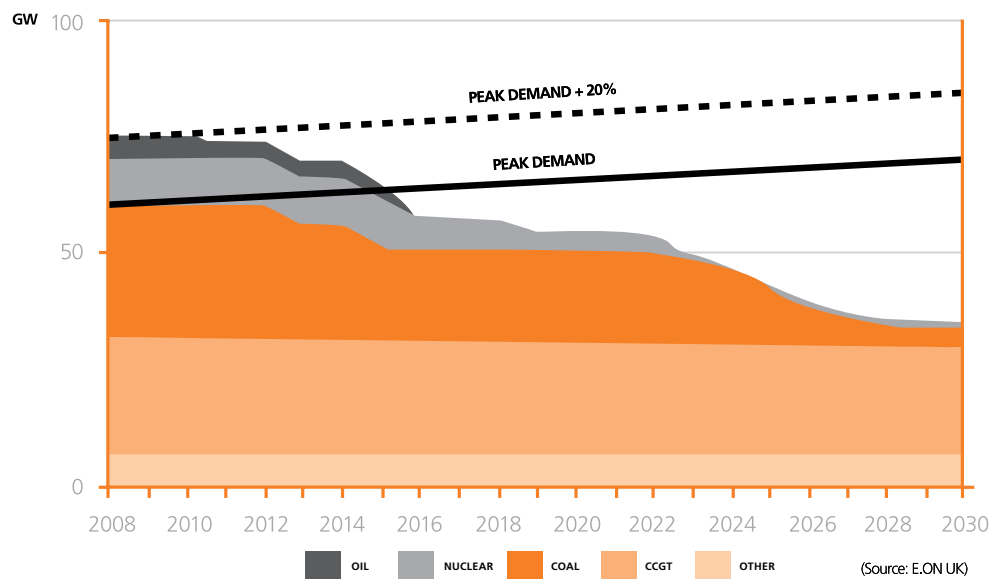
KEY RECOMMENDATIONS:

- Take urgent decisions on nuclear power, renewable energy and carbon capture & storage for coal fired power stations
- Deliver existing energy strategies and future National Policy Statements to create a delivery plan that sets out:
 - clear timelines for government action
 - a programme of active engagement with asset owners, infrastructure suppliers and financiers
- Retrofit our current building stock to make it energy efficient

ENERGY

In the next 10 years, eight nuclear power stations will come to the end of their functioning life. A further eight gigawatts will be lost when six coal-fired power stations close under the Large Combustion Plant Directive (by 2015 at the latest).³ Without new energy generation there will be a shortfall that will affect all the UK's infrastructure.

FIG.1 UK Supply-demand gap to 2030



CONDITION AND CAPACITY

Much of the UK's electricity generation capacity is nearing the end of its life and needs to be renewed over the next ten years.

RESILIENCE

The UK's electricity generation is currently resilient, but the spare capacity above peak demand continues to erode.

SUSTAINABILITY

Most of our production of electricity is not sustainable. The UK relies on considerable imports of energy from other countries, and is heavily dependent on fossil fuels. Much of our housing and office stock is energy-inefficient.

IMPACT OF SIGNIFICANT CUTS

There will be severe consequences if funding to the energy sector is cut. Maximum supply is close to peak demand and infrastructure needs to be renewed now. The lights will go out without action now.

FIVE YEAR VIEW

The next five years are crucial for the energy sector. In this period electricity, heat, and the grid must be renewed in part to meet the UK's carbon targets and increased levels of demand.

3. Bird, J. (August 2007) Energy Security in the UK: An ippr fact file. Institute for Public Policy Research.



Image credit: Aquamarine Power

Currently, the UK has 83.5 gigawatts of capacity (plus 2.5 gigawatts from abroad). Peak demand in winter is 60 gigawatts and 30 large power stations meet the majority of electricity demand. But 11 gigawatts of coal and oil power stations will close by 2015 and 7 gigawatts of nuclear plants will reach the end of their operating life by 2018. At the same time, demand will increase because of electrification in other sectors. For example, electrification is a favoured option to reduce carbon emissions from rail travel. This increase must be factored into any future models for demand.

ELECTRICITY

Many of the UK's power stations are nearing the end of their lives. At peak demand there is little spare capacity and infrastructure needs to be renewed now – an energy gap will be with us in less than five years. Together with legally binding targets to reduce greenhouse gas emissions, this means a major change in electricity infrastructure.

For the UK to get a new energy mix, a secure supply and competitive energy costs, we need an energy infrastructure delivery plan with a 10-50 year time frame. This must deliver energy infrastructure with a drastically lower carbon footprint than the current one.

Achieving this will mean using a mix of renewable and non-fossil fuel generation, including nuclear and energy from waste. To accommodate these new sustainable energy sources, the grid will need to be upgraded.

Any energy infrastructure delivery plan must also reduce the risks inherent in overexposure to imported gas supply. The UK needs to increase gas storage capacity – the UK has one of the lowest per capita gas storage capacities in Europe.

ICE supports nuclear power generation as part of a low carbon energy mix. There is evidence – from the nuclear sector – that an energy infrastructure delivery plan can bring success. The Office of Nuclear Development has supported its infrastructure strategy through active government. By working with the industry to enable investment in the UK, it is on course to getting energy companies to commit to build up to 16 gigawatts of new nuclear⁴ power stations.

If an energy infrastructure delivery plan is to succeed, it must include details of how the government will help in areas such as planning and licensing – and how its fiscal policy will provide a clear and stable framework for investors.

Just as vitally, the plan must set out how we can research and develop new technologies such as tidal and wave power. And it must drive the move to energy efficiency throughout the UK, including retrofitting housing stock.

HEAT

Heating of homes and other buildings accounts for 49% of energy demand.⁵ To meet this effectively and efficiently, we need new capacity in electricity generation and Combined Heat and Power (CHP) with district heating systems.

We have little CHP or district heating in the UK. This is a missed opportunity. Power stations produce up to twice as much energy in waste heat as they produce in electricity. We must use as much of this as possible to heat our homes and workplaces.

And we must make more effort to use the heat we produce efficiently. Many of our houses and office buildings don't keep us warm in winter or cool in summer. Regulations specify insulation for new buildings but more than 90% of our future buildings are already constructed with poor or no insulation. Considerably more effort is required to insulate our existing buildings.

4. http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/nuclear/office/office.aspx
5. Why Waste Heat? May 2009. Institution of Civil Engineers.

GRADE

B

KEY RECOMMENDATIONS:

- Enable the construction of new high-speed rail routes and provide investment in our existing railway network to increase capacity, maintain reliability and reduce journey times
- Tackle chronic highway congestion and improve resilience by using managed motorways, and investing in widening and junction improvements to increase capacity at pinch-points
- Introduce road user charging or some other form of demand management to manage our limited road space

STRATEGIC TRANSPORT NETWORKS⁶

CONDITION AND CAPACITY

Generally in good condition, but most strategic networks are running at full capacity.

RESILIENCE

There is little or no resilience in the system – even minor incidents can lead to severe congestion and delays.

SUSTAINABILITY

Strong leadership will be required from government to help shift carbon-intensive journeys onto more sustainable modes through measures such as road user charging or other forms of demand management and additional public transport capacity.

IMPACT OF SIGNIFICANT CUTS

This would put the positive effects from significant investment made over recent years at risk and cost more to recover in the long-term.

FIVE YEAR VIEW

Plans for rail improvements and high speed rail are welcome. The government's aviation and airports policy is in urgent need of review.

RAIL

Over the past 10 years, the number of rail journeys made has risen by 40% but there has only been a modest increase in capacity over the same period, which was mainly due to the introduction of Heathrow Express and High Speed 1 from London St. Pancras. As a result, important routes are congested and trains are crowded at peak times. The UK urgently needs additional track and carriage capacity.

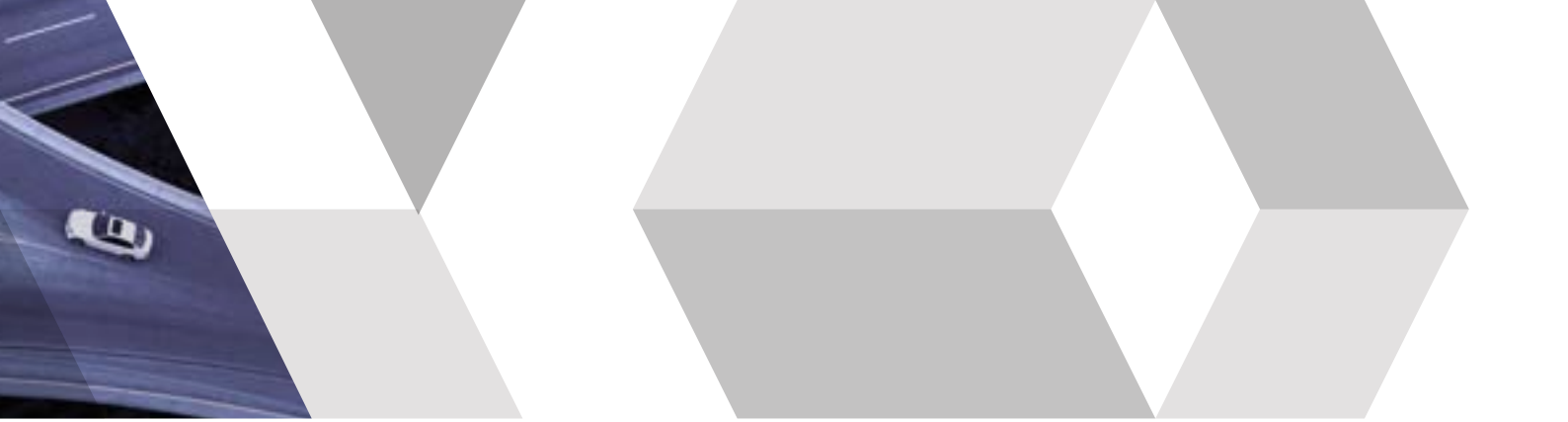
ICE supports plans to invest £10 billion in enhancing capacity over the next six years. We also welcome the planned £15 billion overall support for the railway network – in particular the promise to introduce 1,300 additional carriages in England by 2014.

If this investment takes place, the network should be able to continue to run a reliable, safe and punctual service. But the network would still be constrained and a lack of spare capacity would make it vulnerable to incidents.

So ICE also welcomes plans for the delivery of a new high-speed rail network in the medium-term. This will significantly increase rail capacity and shorten journey times. Reducing journey times between major towns and cities to less than three and a half hours would help provide an alternative to car and domestic short-haul air journeys, thus contribute to reducing carbon emissions and easing congestion on motorways.

The condition of the UK's existing railway track is relatively good thanks to a continuing programme of track upgrades and repairs.

ICE supports the government's long-term programme of track electrification since per seat kilometre electric trains emit 20-35% less carbon than diesel trains – based on the current electricity generation mix. With a decarbonised electricity generation sector, carbon performance would be even better. Currently, just 40% of the rail network is electrified.



STRATEGIC HIGHWAYS

Highways are suffering from record levels of congestion and regular delays as traffic increases faster than the available road space. We must find ways to increase capacity now.

Solutions to manage our motorways, such as the hard-shoulder running already seen around Birmingham, will help in the short-term – alleviating congestion at pinch-points and during peak times. But this will not be enough to cope with the significant traffic growth that is forecast.

What is more, managed motorways provide no resilience for incidents. With no spare road space, an accident or breakdown will inevitably result in lengthy queues. So ICE wants to see selected widening and junction improvements to prevent vehicles queuing onto the motorway from exit slips.

But increased capacity is not enough. In the long-term, ICE strongly supports the introduction of a system of demand management for our limited road space to help reduce congestion. If we fail to reduce demand and provide public transport alternatives, road users will be subject to even longer delays. Unfortunately, there seems to be no political will for action.

Growing levels of carbon emissions are another reason we must reduce demand on our roads and find other ways to move people and goods around the country. In the UK, road travel accounts for 92% of the domestic transport sector's total emissions. Despite improvements to fuel efficiency, this figure is likely to increase as more vehicles use the roads.

The UK's motorway and trunk road network is generally in good condition and to ensure it remains well maintained we must avoid major funding cuts. Financial cuts would likely force the Highways Agency to move to inefficient reactive repairs rather than delivering better value planned preventative programmes. The result could also be a deterioration of the strategic highway network and cost much more to recover from in the long run.

AIR

The government urgently needs to review its aviation and airports strategy.

London Heathrow and London Gatwick are operating at full capacity. As a result, delays could worsen as aircraft queue on the ground and in the air, and unnecessarily add to the sector's current carbon emissions levels. Following recent announcements to abandon runway expansion projects at Heathrow and Stansted airports, the government must re-evaluate its options to provide additional capacity at our congested airports.

North European competitors are developing bigger and more attractive national airports such as Paris Charles de Gaulle and Amsterdam Schiphol. These have the potential to offer a greater range of destinations than Heathrow. So if delays persist, we could see airlines starting to abandon Heathrow – reducing the UK's international connectivity and threatening our national prosperity.

A review of national aviation policy must seek to identify solutions to runway capacity constraints, improve integration with other transport networks, enable growth of air links to and from emerging economies, yet at the same time to reduce the sector's carbon emissions levels.

ICE will lead this debate when we issue our policy on airports in the summer of 2010.

PORTS

Demand for port capacity varies with the state of the economy, but by 2030 container traffic is forecast to increase by 183% and roll-on roll-off traffic to double.⁷ This could put pressure on the UK's most congested ports. But perhaps the most worrying trend is the growing congestion on roads and railways to and from ports. If not addressed soon, this could blight the future performance of our port infrastructure.

Almost a third of total tonnage passes through ports in the South East of England. Pressures for port expansion are greatest at ports handling container and roll-on roll-off traffic – those in the South East of England as well as Liverpool, Grimsby and Immingham. These ports need investment to ensure the UK's competitiveness as a trading nation.

While the carbon impact of ports themselves is difficult to measure, domestic shipping is estimated to account for 3.7% of the domestic transport sector's total emissions. More must be done to reduce the carbon impact of shipping and linking transport networks if the UK is to meet its target of reducing carbon emissions by 80% by 2050.



6. Long Distance Road, Rail, Ports and Airports
7. Excluding transhipments

GRADE

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KEY RECOMMENDATIONS:

- **Improve the condition of the local road network through good asset management and adequate funding**
- **Provide alternatives to private car use by integrating local public transport modes and improving connections to the national network**
- **Manage the demand for private car journeys and encourage a shift to more sustainable modes**

LOCAL TRANSPORT⁸

CONDITION AND CAPACITY

Local roads are generally in poor condition and are congested in town and city centres.

RESILIENCE

The biggest risks to road condition are freezing weather and limited winter salt supply.

SUSTAINABILITY

To encourage a shift away from the private car, improvements need to be made to local public transport capacity and its integration with our national transport networks.

IMPACT OF SIGNIFICANT CUTS

This would be disastrous as local roads are already underfunded and in dire condition.

FIVE YEAR VIEW

Without increased investment significant improvement to condition seems unlikely.

LOCAL ROADS

To ensure our local roads are well maintained we not only need to invest more but also spend that money more wisely. Congestion will remain a problem unless we manage demand at peak times and provide sufficient public transport alternatives.

Local roads are generally in poor condition and there is a huge backlog of maintenance work. The harshest winter in a generation has created a 40% increase in the number of potholes, but there is also an underlying funding problem. Local authorities say that it will take £11.6 billion to bring local roads up to a reasonable condition (England and Wales £9.5 billion⁹; Scotland £1.5 billion¹⁰; Northern Ireland £0.6 billion¹¹).

Despite a modest increase, funding remains inadequate. In England and Wales, there is a budget shortfall of £1.2 billion a year across all local authorities.¹² To clear the backlog would on average take 11.5 years and cost local authorities over £40 million each.¹³ In Scotland, if funding does not increase, the budget shortfall is forecast to increase by another £1 billion in 10 years.

Good maintenance of local roads is vital:

- it protects a valuable and essential asset – if we allow our roads to degrade it will cost more to restore them to good condition than simply maintain them in the first place
- it improves road safety, especially for vulnerable road users such as cyclists
- it reduces public liability claims

So any cut in road maintenance funding would be disastrous, both for the value of the asset and for road safety.

⁸. local roads, buses, light rail, and commuter rail ⁹. AIA (2010) Annual Local Authority Road Maintenance Survey 2009-10. AIA, London ¹⁰. SCOTS (2010) State of the Scottish Road Network. SCOTS, Edinburgh. ¹¹. Department of Regional Development NI (2009) Review of the Structural Funding Requirements for the Roads Service. Prof MS Snaith, DRDNI, Belfast. ¹². AIA (2010) Annual Local Authority Road Maintenance Survey 2009-10. AIA, London ¹³. AIA (2010) Annual Local Authority Road Maintenance Survey 2009-10. AIA, London ¹⁴. DfT (2009) Transport Trends. TSO, London ¹⁵. Docklands, Croydon Tramlink, Sheffield Supertram, Manchester Metrolink, Nexus Tyne and Wear, Centro West Midlands, Nottingham NET and Blackpool Tram.



Good asset management – with asset registers, reasonable policies and standards, inspection and repair regimes – is essential for making sure road budgets are spent most efficiently. However, in order to move to more efficient and well-managed planned preventative programmes of road maintenance, sufficient funding must be provided so that local authorities can do more than just patch pot holes with quick fixes. We can't afford just to make do and mend.

Trenches for gas, water, electricity and other utilities are one of the major causes of road damage – leaving the road structure weak.

Another issue is that the move to unitary, multi-functional authorities has resulted in too many local road authorities. This means that roads departments are often combined with other departments – diluting specialist skills and capacities such as good asset management or the ability to maintain a strategic reserve of winter salt.

Even with improvements to asset management practices and road conditions, peak time congestion on urban roads will remain a major problem unless we take immediate action. Growing congestion is causing longer delays and making journey times less reliable. Big increases in local road capacity are unrealistic and unsustainable. So to tackle congestion we must encourage a shift to public transport, use intelligent transport systems (such as urban traffic management and control) and manage demand through road pricing or some other form of demand management.

LOCAL PUBLIC TRANSPORT

Buses, commuter trains and light rail have the potential to take much of the strain off our local roads. But in order for them to fulfil their potential we must create a more integrated public transport network and improve connections between local public transport and the national network.

Over the last 30 years, local buses have carried fewer and fewer passengers. This trend has begun to reverse in the last eight years, but¹⁴ only because of increased bus use in London and the introduction of free concessionary travel for elderly and disabled passengers.

Why aren't we using our buses? Outside London, the privatised and largely deregulated bus routes are not integrated and do not reliably or adequately meet the public need. Unless frequent bus services are provided to destinations passengers want to travel to, they will have no choice but to drive. Car journeys must also be better integrated with regular, reliable public transport services – with more initiatives such as park and ride schemes for busy towns and cities.

Light rail has been more of a success story. Between them, the eight light rail systems¹⁵ in England accounted for around 4% of local public transport journeys in 2007/08 (186 million passenger journeys). This is nearly three times as many journeys as were made on light rail 20 years ago and is the result of new lines and the extension of existing track. Building more light rail networks could get more people onto public transport.

ICE also seeks a commitment from government that there will be no regional or rural rail line closures, unless they are replaced by the highest quality alternatives.

What does an effective public transport infrastructure network look like? London is an exemplar. The city enjoys frequent buses, efficient mass transit, and significant investment in schemes such as Crossrail and improvements to Thameslink and the East London line.





GRADE

B

KEY RECOMMENDATIONS:

- **Reform the regulatory regime to drive the long-term investments necessary to address climate change, population growth and overall water infrastructure sustainability and avoid stop-start investment**
- **Reduce demand for drinking water by changing the pricing structure, reducing leaks and using low-flow fixtures, supported by water metering**
- **Reduce the volume of water treated at wastewater works by separating flows of sewage and surface water**

WATER AND WASTEWATER

Regulation of the UK's water industry needs to change if it is to reduce its carbon emissions, respond to climate change, support future population growth and maintain environmental standards. We now face a number of major new challenges that threaten not only the progress we have made but also our long-term water security.

CONDITION AND CAPACITY

Thanks to 20 years of regulatory-driven investment, the nation's water infrastructure is serving its customers well in almost all respects and is mostly in good condition.

RESILIENCE

The lack of resilience demonstrated during the 2005-06 droughts and the 2007 floods is being addressed in the 2010-15 regulatory period. However, resilience is declining due to climate change.

SUSTAINABILITY

Without major reductions in demand, the nation's water infrastructure cannot meet the government's long-term targets for carbon emissions. Today emissions are still increasing.

IMPACT OF SIGNIFICANT CUTS

A cut in funding is more likely to hit operational and maintenance spending rather than capital investment. Cuts may cause more sewer flooding and water pollution incidents and reduce customer service levels.

FIVE YEAR VIEW

Five years from now the nation's water infrastructure will have less drought resilience. It will have made little progress in preparing for climate change and population growth or reducing its carbon emissions.

The current framework focuses on short-term costs in place of long-term sustainability and customer needs. It simply can't cope with issues that require investment beyond the five-year regulatory cycle. It is also hampered by a lack of joined-up thinking and action between the many regulatory bodies.

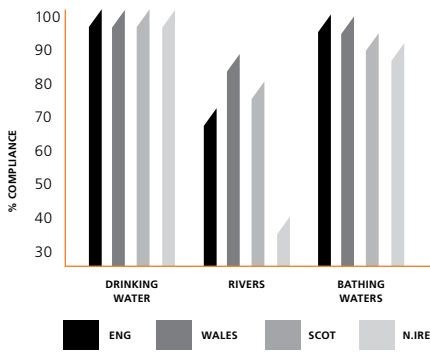
Having said that, the current structure has been good for our water infrastructure over the past 20 years. The £85 billion¹⁶ invested in the sector during this time in England and Wales (and more recent investment in Scotland and Northern Ireland) means that infrastructure meets our current needs. Customers enjoy good value and excellent drinking water quality. And companies are delivering better environmental compliance, enhancing the quality of our rivers and coastal waters.

As shown in the chart opposite, drinking water quality is excellent.¹⁷ Most rivers are at good or better quality,^{18 19} except in Northern Ireland.²⁰ Nearly all bathing waters meet minimum standards.^{21 22 23 24} Serious water pollution incidents (due to the release of crude or untreated effluent) have reduced to 55 per year for England and Wales from more than twice as many five years earlier.²⁵ And leakage levels are at or below targets in England and Wales,²⁶ although they are higher in Scotland and Northern Ireland.

16. Ofwat: Service and delivery – performance of the water companies in England and Wales 2008-09 17. England & Wales, DWI, June 09; Scotland, DWQR, August 09; N. Ireland, Drinking Water Inspectorate, October 2009. 18. Environment Agency: Rivers of good or excellent quality 1990-2008. 19. Scottish Environmental Protection Agency: National Water Quality Classification 2006. 20. Department of the Environment Northern Ireland: Environmental Statistics Report January 2010. 21. Environment Agency: Bathing Water Quality 2009. 22. Scottish Environmental Protection Agency: Scottish Bathing Waters 2009. 23. Northern Ireland Environment Agency: Bathing waters in Northern Ireland 2009. 24. These percentages will reduce to 82% (England and Wales), 56% (Scotland) and 46% (Northern Ireland). 25. Ofwat: Service and delivery – performance of the water companies in England and Wales 2008-09 26. Ofwat: Service and delivery – performance of the water companies in England and Wales 2008-09 27. Severn Trent Water: Changing Course – Delivering a sustainable future for the water industry in England and Wales January 2010. 28. The level of investment in Northern Ireland is very vulnerable as Northern Ireland Water is funded directly by government, rather than by its customers. And introducing water charging to customers has been deferred several times. 29. For example, Northern Ireland Water plans to generate 15% from renewables by 2015, and Severn Trent Water 30% by 2015



FIG.2 Water quality



However, the pace of improvement in England and Wales has slowed in the most recent regulatory period (2005-2010). This is despite maintaining the level of capital investment in the sector.

Extreme events such as the droughts of 2005 and 2006 and the floods of July 2007 show that resilience is vital. It will be even more vital as the climate changes. To improve resilience, the regulated water companies have evaluated their assets, and are making additional investments. ICE welcomes this.

Water utilities also need to be financially strong – and the regulators’ remits include maintaining the financial stability of the sector. The 2009 Ofwat price review has been accepted by all except one regulated water company. This indicates that the companies believe the prices set for 2010-2015 will allow them to fund their investment programmes. However, any variation from the financial assumptions used in the determination – such as the cost of capital or inflation – could jeopardise the availability of finance. In the longer term, the industry may not be financially sustainable as currently structured and regulated.²⁷

The sector has a funded business plan for 2010-15. So, except for Northern Ireland,²⁸ it should not be under the same pressures to reduce capital expenditure as publicly-owned infrastructure. It must maintain the confidence of investors so that it can continue to fund capital investments. Shareholder pressure to reduce operating expenditures could lead to reductions in customer service levels. But as the drinking water infrastructure is in good condition, a short-term reduction in maintenance is unlikely to cause long-term harm.

Things are different for wastewater infrastructure. It has many underground assets whose location, age and condition are inadequately recorded and understood. And maintenance tends to be reactive rather than planned. Any short-term reduction in maintenance is likely to cause additional sewer flooding and water pollution incidents.

Ofwat’s price review has had one unfortunate consequence. Coming at the same time as similar reviews in Scotland and Northern Ireland, and occurring during the recession, it has created a perfect storm for the industry. Due to the slowdown of capital investment that occurs during each price review – compounded in 2009 by credit shortages – some supply chain companies and many experienced people have left the sector. This loss of experience and talent is not being addressed and represents a risk to the future of the water industry.

The sector will need all the experience and talent at its disposal to address the challenges of sustainability and population growth. Current efforts are inadequate. Although water companies are required to estimate carbon emissions for new infrastructure and most measure their carbon footprint, few are using carbon evaluations in all their capital investment decision-making. Although some companies do have plans to increase their production of renewable energy to cut their carbon footprint,²⁹ they will be insufficient to meet the government’s long-term emissions targets and other companies are not following their lead.

In fact, water industry energy use has nearly doubled since 1990.³⁰ This is largely due to capital investments made to address recent environmental regulations to do with water quality – which are still increasing. With more investment needed to address new regulations, carbon emissions will increase further. To meet government targets, reductions of at least 60% are needed by 2050.³¹

Even with innovation, ICE believes that the industry cannot reduce its carbon footprint enough to meet government targets without large reductions in the demand for water and the volume of wastewater treated. Water infrastructure must help us all to use less water. Metering and low-use fixtures must be used more widely.

Customers must be encouraged to change their behaviour. And we must treat less wastewater, by using regulation to encourage separation of sewage and surface water drainage and using localised natural infiltration techniques in developments. ICE supports the Scottish regulator’s initiatives in these areas.³²

Investments planned for 2010-15 do not do enough to address the effects of climate change.³³ They don’t adequately take into account future population growth. They don’t reduce demand. They don’t allow for environmental regulation such as the Water Framework Directive. And they don’t fully include the 25-year plans prepared by the water companies before the recent price review. Although there is much uncertainty in these areas, we need action and regulatory changes now if long-term investments are to be accepted in the next price reviews. We welcome Ofwat’s Future Regulation programme but it needs to be much faster.³⁴

For example, climate change is expected to reduce groundwater yields and summer river flows. At the same time, the Water Framework Directive means that abstraction licenses and effluent discharge permits granted by the Environment Agency will become much more restrictive. Some parts of the country earmarked for population growth – particularly areas in the South East – will be hard hit. Combined with a lack of funding for further leakage reduction and little emphasis on demand management, the result will be water shortages in times of drought.

The recent Walker review on charging for water³⁵ also concluded that regulatory changes are needed. ICE supports the review’s recommendations, and agrees that the mismatch between how we value water now and how we will need to do so in the future is a key issue; the perceived value of water is a key influence on customer behaviour. Today, water seems cheap and plentiful but this will not be the case in the future. If we are to have sustainable water infrastructure, the charging system must be changed to encourage us to use water efficiently.

(from its present 17.5% (2008/09)), **30**. Water industry’s vigorous response to the challenge of climate change. July 2007. Water UK. <http://www.water.org.uk/home/news/press-releases/industry-s-response-to-cc> **31**. Cutting carbon emissions: Water UK industry checklist. January 2008. Water UK **32**. Water Industry Commission for Scotland: The Strategic Review of Charges for 2010-2015: The Final Determination pp.23-25 November 2009 **33**. Climate change impacts were not adequately included, in part because the government’s UK Climate Projections 2009 were not available at the time. **34**. Ofwat: Addressing Future Challenges (<http://www.ofwat.gov.uk/future/>) May 2009 (these are the 2 new additions) **35**. Defra: The Independent Review of Charging for Household Water and Sewerage Services December 2009

GRADE

C

KEY RECOMMENDATIONS:

- **Improve efficiency through long-term planning, collaborative working and setting performance targets for flood infrastructure**
- **Improve community engagement to agree realistic expectations about flood risk. Highlight the opportunities available for people and communities to reduce flood risk and improve resilience**
- **Increase the use of adaptive natural drainage systems such as sustainable urban drainage systems**

FLOOD RISK MANAGEMENT

Managing flood and coastal risk infrastructure is essential for future economic growth and sustainability. There are millions of domestic and commercial properties and a significant amount of transport infrastructure at risk of flooding from the sea, rivers and surface water.

CONDITION AND CAPACITY

The condition of our flood and coastal risk management infrastructure assets varies greatly. This is made worse because it's not clear who owns what, organisations don't work together and there's a lack of integrated knowledge about flood and coastal risk infrastructure.

RESILIENCE

Flood and coastal risk management infrastructure is resilient now but climate change will reduce its ability to cope.

SUSTAINABILITY

Flood risk management in its current form is not sustainable. It will only become sustainable when we rethink how we design and develop our communities.

IMPACT OF SIGNIFICANT CUTS

A one-year budget cut would have a major impact on the lowest priority infrastructure and operating authority services.

FIVE YEAR VIEW

Much of the existing infrastructure does not take account of – and will not be able to cope with – predicted population growth and climate change.

Managing flood and coastal risk infrastructure is essential for future economic growth and sustainability. There are 5.2 million properties at risk of flooding from the sea, rivers and surface water in England.³⁶ In the Thames estuary alone, over 500,000 properties (worth £200 billion), 1.25 million people, 40,000 commercial and industrial properties, and a significant amount of transport infrastructure are at risk of tidal flooding.³⁷ What's more, investment in flood and coastal risk infrastructure also has the potential to stimulate redevelopment and attract investment.³⁸

But as things stand we simply don't know enough about the infrastructure that protects us from coastal, river, surface water, sewer, groundwater and reservoir flooding. Operating bodies don't all hold the same data about the condition of infrastructure assets – everything from sea walls to river levees. And this is exacerbated by a lack of clear and coordinated ownership, collaboration and integrated knowledge. There is potential to make our flooding infrastructure more efficient and more effective through simple coordination.

³⁶. Investing for the future. Flood and coastal risk management in England, A long-term investment strategy. 2009. Environment Agency.

³⁷. Thames Estuary 2100 Strategic Environmental Assessment April 2009. Environment Agency ³⁸. Facing up to rising sea levels. January 2010. Institution of Civil Engineers and RIBA Building Futures. ³⁹. Investing for the future. Flood and coastal risk management in England, A long-term investment strategy. 2009. Environment Agency.



Adapting to future change is a key consideration for new flood and coastal risk management infrastructure. Much of our existing infrastructure – particularly sub-surface infrastructure – does not take account of future population growth and will not be able to cope beyond a few more decades. But climate change is undoubtedly the largest driver for change to flood and coastal risk management infrastructure.

Continued investment in flood risk management is vital. But an improved vision about how UK towns and cities can cope with and avoid floods is just as important. The Environment Agency's (EA) long-term investment strategy shows that just maintaining current standards of protection from river and coastal flooding as the climate changes will cost around £1 billion every year by 2035 – an 80% increase on today's levels. And this excludes the costs of managing surface and groundwater flood risk. Although continued funding for flood risk management is essential for the duration of the current parliament, we need a longer-term, sustainable vision which accepts some changes in our shoreline and climate.

Sound investment in future flood and coastal risk management infrastructure will reduce post-flood costs. Every £1 invested in new or improvement flood and coastal risk infrastructure returns £8 of benefit on average.³⁹ And money is only spent where the economic benefits significantly outweigh the costs.

Not investing or planning now will mean greater costs later as we deal with flooding and erosion. Deferring flood and coastal risk investment and strategy decisions will appear prudent only if we are lucky enough not to encounter extreme weather.

Long-term planning and investment will enable the coastal risk management industry to make efficiency savings – vital as we recover from the economic crisis and the government reduces its fiscal deficit. In line with recommendations in the Pitt Review, local communities, businesses and developers could be encouraged to contribute.

Although our current infrastructure delivers some flood protection to our communities, this sector is in need of fundamental change. Flooding is a very real risk in the UK and one that is only going to increase. If we rely solely on flood defences and ever larger drains, we will not be able to keep pace with climate change. If managing flood risk only means building additional defences, we will quickly run out of money and only increase the carbon footprint of this sector. We need to rethink our approach to urban design and the development of our urban communities. Flood risk management must be at the start of the planning and development process, not at the end.

CASE STUDY: SURFACE WATER AND SEWER FLOOD RISK

In summer 2007, a lack of surface water and sewer drainage capacity (and poor management of the corresponding water flows that could not be contained) resulted in floods that caused at least £1.6 billion of damage. Of the 5.2 million properties currently at risk of flooding in England, twice as many are at risk from surface water flooding as from river and coastal flooding. Yet the governance, management and investment in surface water and sewer flood risk is unclear, under-resourced and under-funded.

The Flood and Water Management Act will make responsibilities in this sector clear. Local authorities will play a key role in understanding flood risk and coordinating the activities of others to reduce risks. But they will be hampered by a lack of resources and skilled personnel. And uncertainty remains over national sustainable urban drainage systems standards, which are still being drafted. Led by local authorities, surface water management plans will make water companies, the EA and other partners work together to understand and reduce surface water flood risk.



GRADE

C

KEY RECOMMENDATIONS:

- **Develop a national resource management infrastructure plan to drive the delivery of facilities required to meet waste management, energy, materials and climate change policy goals**
- **Reduce waste by designing it out at source**
- **Improve the integration of the management of municipal and commercial & industrial waste**

WASTE AND RESOURCE MANAGEMENT

CONDITION AND CAPACITY

There is not enough suitable waste treatment and reprocessing capacity. Major public and private investment is currently being put in place to address this shortfall. This will need to continue for the foreseeable future if the UK is to bring more material back into beneficial use and meet its landfill diversion and carbon reduction targets.

RESILIENCE

The current mix of technologies and waste facilities may not cope with the changing volume and composition of waste in the UK. The potential for greater integration between waste treatment, energy generation and material supply is unfulfilled, so we are missing opportunities to improve the resilience of all three sectors.

SUSTAINABILITY

Diverting valuable material from landfill and returning it to genuinely beneficial use is a key sustainability goal.

IMPACT OF SIGNIFICANT CUTS

A cut in public spending may affect the programme to construct new treatment and reprocessing facilities, which is being led by local authorities. Projects that have been given the go-ahead or are in construction should be unaffected.

FIVE YEAR VIEW

Unless collaboration between the public and private sectors improves and a clear resource management infrastructure plan is put in place, the UK will not have the facilities it needs for a resilient, sustainable waste infrastructure that can also contribute to wider energy and climate change goals.

Since 2005, ICE has argued in a series of reports that the way the UK handles much of its waste amounts to deferred disposal and fails to treat materials as a valuable resource.

Minimising waste will deliver the biggest environmental and economic savings. Waste must be designed out of products, and more of the things we buy need to be designed for easy disassembly and reuse. In addition, more waste materials will need to be separated at source to enable closed loop reuse (where materials like packaging are reused for the same purpose). The construction sector currently accounts for 32% of waste in England and can make a major contribution in this area.

Where materials such as glass, paper and plastics have been discarded by their original owner, we should look to find the most beneficial use for them – whether they come from homes, offices or factories. Currently our waste infrastructure focuses on managing household, commercial, industrial, construction and demolition waste streams separately.

Infrastructure must support the movement of materials back into the economy. The waste industry should become a supplier of high quality materials for manufacturers, compost for agriculture and fuel for energy from waste (EfW). This approach could help cut the UK's carbon footprint by reducing the need to extract and process raw materials. It could also contribute to a diverse and secure energy mix.

Unfortunately, significant barriers remain to delivering the infrastructure required to support this vision. What's stopping the UK getting the waste infrastructure it needs?



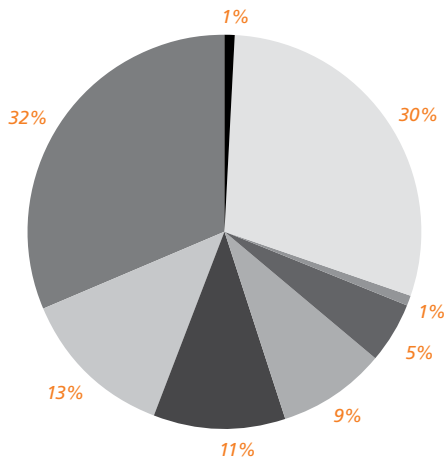


FIG.3 Annual waste arisings, England, by sector (2004)

*Agriculture 1%
Mining and quarrying 30%
Sewage sludge 1%
Dredged material 5%
Household 9%
Commercial 11%
Industrial 13%
Demolition and construction 32%*

Image credit: WRAP

TOO MUCH FOCUS ON MUNICIPAL SOLID WASTE (MSW)

Municipal solid waste (MSW) collected from households and some businesses accounts for just 9% of UK waste, with commercial and industrial waste accounting for 24%. But MSW has been heavily targeted by policy – most notably the EU Landfill Directive, which sets binding targets for diverting MSW from landfill. Responsibility for hitting these targets has been passed to local authorities who, over the last five years, have procured new waste treatment infrastructure to meet them. As a result, 2010 targets have been met and Defra is confident of hitting the next set of targets in 2013.

Planning and financing rules limit the ability of these facilities to accept commercial and industrial waste, collected from businesses, offices and factories, even though much of this material is very similar to MSW. Coordination of procurement between local authorities has been patchy which has stopped the UK from creating an integrated network that could recover and reprocess materials at a commercial scale. Similarly, differences in waste collection and sorting regimes between local authorities undermines efforts to produce material of a uniform, high quality.

Following a recent EU ruling, the UK will have to divert more of its commercial and industrial waste from landfill. However, it is unclear what measures government will introduce to get this material out of landfill and back into beneficial use.

LACK OF CLARITY ON LONG-TERM LANDFILL TAX RATES

Landfill tax has made a big impact on the waste sector and could be extended to provide an incentive to invest in the new facilities we need.

Introduced in 1996, the landfill tax has been steadily ratcheted up and is presently set to rise by £8 per tonne every year until 2013. Critics have argued that the government is failing to provide enough long-term certainty for those investing in new waste facilities. If this 'escalator' was extended until 2020, landfill tax would rise from £40 a tonne to well over £100 a tonne, providing a huge incentive for waste minimisation and private investment in new infrastructure. Such investment is essential if we are to divert commercial and industrial waste from landfill and achieve the economies of scale required to make recycled and secondary materials competitive with raw materials.

LACK OF FINANCE

In the wake of the financial crisis it has become increasingly hard to raise private sector funding for waste facilities, particularly for infrastructure not underpinned by a contract with a local authority to take MSW. Funding is also problematic for newer technologies that have not been proven at scale and in UK conditions.

PLANNING DELAYS AND PUBLIC OPPOSITION

Waste treatment and reprocessing facilities often arouse public opposition. Local authorities and the waste sector have made great strides in public engagement but the planning process for new facilities often remains lengthy and outcomes uncertain, adding to the cost of new infrastructure.

As a result of all these factors, there is a risk that new facilities will not consider strategic issues such as location, scale and technology. To avoid this situation Defra, Department of Energy and Climate Change (DECC), Communities and Local government (CLG) and the Treasury will have to work much more closely. Together they must prioritise goals such as cost-effective waste treatment, energy security, carbon reduction and local economic development. This should be backed by a national resource management infrastructure plan. Implementing this plan will require much greater collaboration between local authorities, and between the public and private sectors.

THE LANDFILL DIRECTIVE

The directive:

- Requires a substantial reduction in the amount of biodegradable municipal waste (BMW) being landfilled
- By 2010 to reduce BMW landfilled to 75% (by weight) of that produced in 1995
- By 2013 to reduce BMW landfilled to 50% (by weight) of that produced in 1995
- By 2020 to reduce BMW landfilled to 35% (by weight) of that produced in 1995

Source: EA, Defra, British Geological Society, Water UK, CEFAS, DCLG.

SUSTAINABILITY

Infrastructure is a conduit for providing communities with their daily essentials, but it is also able to promote and encourage more sustainable consumption patterns, thereby reducing our carbon emissions. In the energy, transport, water, flood risk management and waste resource management sectors we need to understand and calibrate supply and demand to ensure that there is sufficient capacity provided in a sustainable manner.

The water section of this report outlined an example where this balance between supply and demand must be struck. Clean water is vital, but with climate change reducing groundwater yields, and population increasing, there will be additional stress on our water resources. This could result in the UK having to move towards carbon intensive projects such as desalination plants or reservoirs.

However, the solution must balance the need for clean water with the need to reduce the carbon footprint of the water industry.

We must: reduce leakage; increase the use of water meters and low use fixtures; employ low energy treatment solutions; inform consumer behaviour; ensure the charges for water reflect its true value.

Similar to these measures in the water industry, each sector has clear potential to reduce demand, through both innovation and behavioural change; through energy savings in the home and workplace; greater use of public transport; car sharing, walking and cycling; reducing and recycling solid waste; and changing the way we think about flood risk management.

Infrastructure owners, operators and clients should focus on implementing efficiency and demand management measures and creating clear plans for rolling out proven low carbon technologies. Government and private sector clients have clear roles to play in influencing demand and promoting behavioural change, both individually and corporately.

Individual infrastructure assets are part of larger networks and are dependent on other sectors. These interdependencies need to be fully recognised across government departments. For the transport sector to reduce its carbon emissions, it is essential for the energy sector to be decarbonised. The electrification of the rail network therefore requires electricity from low carbon sources to optimise its carbon performance.

Examples of interdependency of infrastructure sectors and their carbon footprints are many – waste resource management and transport, water and energy, waste resource management and energy. Hence, an inter-departmental structure is needed that addresses carbon accounting, low carbon supply and demand management.

We have argued in previous State of the Nation reports that a holistic approach is needed to infrastructure resilience⁴⁰, and to reduce the whole life carbon footprint of infrastructure. Engineers, utilities, operators and investors need to understand the carbon implications of the interactions between infrastructure assets,⁴¹ people and machines.

Government and industry can improve sustainability now. Energy efficiency through improved home insulation, energy efficient appliances and smart appliances can, in the short term, address some of the supply and demand challenges that currently exist within the energy sector. Over the long term, investments must be made in a smart grid, low carbon energy and in reducing overall transport emissions through modal shift and improved transport technology.

Sustainability and supply/demand challenges are best examined over longer timeframes. Infrastructure UK should promote a systems approach to managing carbon across infrastructure networks and coordinate low carbon policy across relevant government departments.

The tension between supply and demand is more evident than ever for UK infrastructure. As it grapples to meet demand, engineers must not take the traditional 'predict and provide' approach to services. Instead, there must be a balanced attitude across economic stability and progress; environmental protection and enhancement; and social equity and inclusion.

The UK infrastructure industry has much to offer the global market. It should take full advantage of the opportunity to grow the construction sector and make lasting impacts on the international field, in both developed and developing nation locations. The industry must de-carbonise its own activity across all phases of the supply chain. It must provide infrastructure for supplying clean energy and enabling sustainable practices in areas of the economy, such as transport and agriculture. It must complement this by constructing buildings and developing technologies that enable people to lead more energy efficient lives. The advent of these low carbon economy initiatives can generate new employment, provide emerging low energy technologies and protect the environment.

A systems approach, which includes the implementation of a universal carbon accounting system, is needed and will require greater knowledge-sharing and joint working between engineering and built environment professionals of all disciplines.

⁴⁰. ICE (2009) State of the Nation Defending Critical Infrastructure. Institution of Civil Engineers, London.

⁴¹. ICE (2009) State of the Nation Low Carbon Infrastructure. Institution of Civil Engineers, London.



CAPACITY AND SKILLS

The construction industry has been severely affected by the recession and short-term demand for civil engineering skills has declined. It is vital that the UK does not repeat the mistakes of the 1990s recession when significant capacity was permanently lost. This was a major factor in the skills shortages that subsequently affected the industry.

The government has begun to address the strategic level weakness identified in ICE's 2008 report, *State of the Nation: Capacity and Skills*. Created in 2009, Infrastructure UK (IUK) should provide a clearer picture of long-term demand through its 5-50 year framework for developing UK infrastructure networks.

Working with the newly appointed Chief Construction Advisor, I-UK is also ideally placed to improve the coordination of new-build and maintenance programmes across different infrastructure networks.

Finally, the Planning Act 2008 has created a new consenting regime for major projects. This should be faster and more predictable for all concerned.

Together, these reforms can help break the stop-start pattern of infrastructure development that has undermined efforts to increase the skilled labour force and its capacity in recent decades. The new government must give these reforms an opportunity to prove their worth.

AGEING CIVIL ENGINEERS

The impending retirement of the baby-boom generation will not leave civil engineering untouched: 41% of ICE members are over 50 years old. Civil engineering companies are finding ways to ensure that the experience of this generation is not prematurely lost to the industry. These include buddy schemes pairing older and younger colleagues and more post-retirement contracts for specific projects.

DECLINING CIVIL ENGINEERING ENTRANTS

At the other end of the age scale, despite a rising number of engineering graduates, recruitment of graduate engineers has declined during the current recession. Lack of career opportunities was the number one concern in a recent survey organised by ICE's Graduates and Students national committee. The government must create incentives for organisations to provide graduate training and apprenticeships. Otherwise large numbers of young people will permanently leave the profession.

INCREASING PRE-19 OPPORTUNITIES

After a long period of decline, more students are taking GCSE and A-level physics – an entry requirement for many engineering courses. However, the Institute of Physics reports that more than one in four state schools are unable to offer A-level physics due to a shortage of teachers. This creates another entry barrier to the profession for a large portion of the population.

Despite this, the downward trend in university students taking STEM (science, technology, engineering and mathematics) subjects that characterised the 1990s has been reversed. The number of first degrees awarded in civil engineering to UK students rose by 44% between 2003/04 and 2007/08.

There are grounds for optimism that cuts to higher education spending will not reverse this trend. Civil engineering is one of the subjects identified by government as supporting future economic growth and has received special support.

The impact of the current round of cuts to university funding on STEM subjects is uncertain. Historically, such cuts have disproportionately affected expensive-to-run science and engineering courses. The government and the Higher Education Funding Council have both tried to protect these areas. But experience suggests that any decline in applications can reduce entry standards as universities struggle to recruit students.

CONCLUSION

Infrastructure UK, the Planning Act and an active Chief Construction Advisor may be able to lessen the impact of structural problems. The response in previous periods of skills shortages has been to import professional skills. But the scale of growth expected in BRIC nations in the coming decade means that demand for engineering skills and therefore their cost will grow. Imported skills will be more expensive.

Universities will continue to adapt to changing trends in lifestyles and funding. While the four year degree will probably remain the preferred route into the profession, there is likely to be an increase in demand for new routes combining workplace learning and part-time study.

ICE is working with industry and academia to ensure these pathways to professional qualification are open but also robust.

FUNDING AND DELIVERY

The Treasury estimates that £30 billion per year has been invested in the UK's infrastructure over the last five years.⁴² From now until 2030, demand for infrastructure investment is estimated between £40 billion and £50 billion annually.⁴³ Given the current financial position, funding this important and overdue increase in infrastructure spending will require effective direction, creativity and delivery.

Infrastructure clients will require more for less: infrastructure that is safer, faster and has lower emissions. It must be secure, affordable and sustainable.

Competing demands are likely to arise from increasing maintenance backlogs, investment to marginally improve capacity and investment to provide additional capacity. Meeting these challenges as well as the 2020 and 2050 emissions targets will be tough.

ICE welcomes both a special planning consent procedure for major projects and the inclusion in the new government's coalition agreement of provision for creating a Green Investment Bank. However we recognise that on their own these interventions will not overcome all the barriers to securing increased funding and improving the delivery of projects. ICE believes that four key steps will be critical in this area:

1. Creating a robust infrastructure strategy
2. Aligning regulatory protocols to investment horizons
3. Developing of robust and complimentary funding models
4. Efficient and effective commissioning, procurement delivery and operation

CREATING A ROBUST INFRASTRUCTURE STRATEGY

- Provide a clear framework to give client bodies, those with commissioning and delivery objectives, the industry supply chain and funders the confidence to invest. This should produce a flow of deals with opportunities to optimise capacity, deliver better value for money and reduce the risk of inflation in the medium-term
- Although new infrastructure is needed, demand management should not be overlooked as an effective tool in the short-term. This will not be a panacea as both whole-life cost and system-wide efficiency may well be compromised
- To address competing demands for resources and to provide greater confidence to key stakeholders, develop a transparent mechanism to prioritise factors such as economic benefit, value for money and affordability
- ICE welcomes I-UK's National Infrastructure Framework, although developing this framework in an efficient and transparent way represents a challenge

ALIGNING REGULATORY PROTOCOLS TO INVESTMENT HORIZONS

- Five-year regulatory periods have helped to manage investment in existing and new infrastructure more effectively. But in some cases they are still not long enough. New technologies will require certainty for longer periods. Very large and critical infrastructure developments such as new nuclear and offshore wind have investment horizons longer than five years and need intervention to secure investment from the private sector
- With little capital available, there is likely to be more pressure to focus on immediate affordability at the expense of long-term value for money and carbon footprint. To ensure that the whole life cost and whole life carbon footprint are considered, we need to re-examine the Green Book and associated guidance

FUNDING MODELS

- Funding infrastructure efficiently and cost-effectively will require a range of models: traditional, public-private partnership (PPP) and more innovative approaches such as the proposed Green Investment Bank or broader National Infrastructure Investment Bank. To avoid potential crowding out, the remits of, and interfaces between, funding models will need to be clearly defined. Differences in acceptable levels of risk and return must be understood
- The management of risk must be carefully considered. It is likely that the desire to transfer, rather than share, risk will increase. This could raise prices and reduce the extent to which schemes are bankable, which could compromise the availability of funding routes
- The opportunity to achieve wider policy ambitions by including minimum requirements for issues such as sustainability and skills in the funding models should be carefully considered
- The pension investment industry is keen for longer term investments and infrastructure vehicles could meet this need. These investments in existing infrastructure will need to represent the best available value for money to the taxpayer and remain competitive in the investment market

COMMISSIONING, PROCUREMENT, DELIVERY AND OPERATIONS

- Optimising efficiency to reduce waste should be a key priority to give the best available value for money. This will place increasing demands on all elements of infrastructure management that do not visibly add value
- Opportunities exist to better integrate infrastructure development and the wider built environment to avoid inefficient competition for funding and skills
- I-UK's forthcoming investigation into the costs of major infrastructure projects in the UK should be welcomed as an opportunity to examine efficiency across the asset life-cycle, from commissioning through to operations

⁴². Budget, HM Treasury, March 2010

⁴³. Strategy for National Infrastructure, HM Treasury, March 2010



PLANNING AND REGULATION

REGULATORY FRAMEWORK

The lack of a holistic government approach to infrastructure has also affected the regulatory framework. Regulatory bodies are meant to enforce policy that has been handed down to them by government – not to create policy of their own. With no specific policy to address issues such as infrastructure resilience, climate change or carbon reduction targets, the regulator cannot address them adequately.

The goals of current regulation are almost wholly economic, focusing on protecting consumers from monopoly. ICE believes that this does not adequately address long-term stewardship of infrastructure. This is not to say that either regulators or private asset owners are ignoring the issue – we do not believe they are. But it is not their main concern. Their focus is consumer price, service level and the bottom line.

As discussed in the water section of this report, all regulated utilities are required to meet standards for protecting elements of infrastructure and are subject to external audit. While government may lay down the standards to be applied, the cost of applying them must be met by the utility company. In practice this means that the cost must be justified to the regulator and then passed on to consumers. So there is a potential conflict between those setting the standards, those required to implement them and those charged with regulating pricing in the market sectors.

For instance, during the last review of the water company investment plans, many water companies found that it was difficult to demonstrate the benefits of flood protection against rare but extreme catastrophic events through normal economic models. This meant that expenditure proposals were difficult to justify and often rejected by the economic regulator.

The current regulatory framework has served the UK well in many aspects. It has brought affordable electricity and clean drinking water among other things. The regulatory framework has driven out inefficiencies and kept consumer prices low. However, consumer price and inefficiency can no longer be addressed in isolation, but along with carbon reduction, climate change adaptation and security of supply. These long-term challenges require government-led change of our regulator framework.

PLANNING

A workable planning system is crucial if we are to build the new infrastructure the UK needs to maintain service levels. It is also particularly important if we are to increase spare capacity within our infrastructure assets and networks.

Acquiring the necessary planning and regulatory consents has hampered large infrastructure projects. For instance, it took six years to approve an essential upgrade to the North Yorkshire power line. A wind farm to power 24,000 homes at Fullbrook Down took three years to approve. And Heathrow T5 took more than seven years, with 37 different applications submitted under seven different acts of Parliament.

Although the planning system for all major infrastructure needs fixing, planning within the energy sector is particularly important.⁴⁴ In the next 10 years, eight nuclear power stations will come to the end of their functioning life. A further eight gigawatts will be lost when six coal-fired power stations close under the Large Combustion Plant Directive (by 2015 at the latest).⁴⁵ Without new energy generation there will be a shortfall that will affect all the UK's infrastructure.

PLANNING ACT AND IPC

There is a history of problems within the planning system. In 2008, the Planning Act was passed to address them. The Act aims to provide a more efficient, transparent and accessible planning system for nationally significant infrastructure projects. The legislation replaces eight previous consent regimes with a single one for major projects such as railways, ports, roads, airports, water and waste infrastructure.⁴⁶

The new independent Infrastructure Planning Commission (IPC) began to take planning applications in early 2010. However, the current coalition government has announced plans to abolish the IPC. It is imperative that whatever replaces the IPC does not delay nationally significant projects such as offshore wind farms and nuclear power.

The abolition of the IPC is not unexpected and ICE is hopeful that if it is replaced swiftly it will not derail the delivery of vital infrastructure.

⁴⁴. Bird, J. (August 2007) Energy Security in the UK: An ippr fact file. Institute for Public Policy Research

⁴⁵. Bird, J. (August 2007) Energy Security in the UK: An ippr fact file. Institute for Public Policy Research.

⁴⁶. Infrastructure Planning Commission implementation: Route map. (January 2009) A report by Communities and Local government.

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