ICE submission to the National Resilience Committee's inquiry on national resilience

April 2026

About the ICE

The Institution of Civil Engineers (ICE) is a 97,000-strong global membership organisation with over 200 years of history.

It is a centre of engineering excellence, qualifying engineers and helping them maintain lifelong competence, assuring society that the infrastructure they create is safe, dependable and well designed.

Its network of experts offers trusted, impartial advice to politicians and decision makers on how to build and adapt infrastructure to create a more sustainable world.

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Submission

The submission focuses on questions 1, 2, 5, 6, 11 and 13 from the call for evidence. It makes the following key points:

- Infrastructure is an interconnected 'system of systems' which faces increasingly complex, combined threats. This amplifies the risk, cost and impacts of cascading service failures across the UK's Critical National Infrastructure assets.
- Through climate change, more frequent and extreme weather events will place growing pressure on critical infrastructure systems, many of which were not designed to withstand them, increasing the risk of deterioration and unpredictable failures.
- Responding to the threat of climate change will require a fundamental shift in governance, with clear leadership and coordinated policy that crosses the traditional silos of government departments.
- The UK's current National Adaptation Programme has been ineffective in driving change. The UK needs clear, actionable resilience and adaptation targets and a well-defined vision for what a resilient UK looks like.
- To incentivise investment in climate resilience and adaptation, the UK Government should undertake a national review of the economics of adaptation to understand the value it provides. The ICE will be conducting further work on how to approach this in 2026.

- Other solutions include more and better data collection and sharing on asset resilience and the nature of potential cascading failures; clear, measurable resilience design standards for new and existing infrastructure assets; smarter land use planning; and greater uptake of nature-based solutions.

Question 1 – How far are national and international risks inter-connected, including across different sectors and across short-term and long-term risks, and what are the implications for the national approach towards preparedness and resilience?

Infrastructure is an interconnected 'system of systems' that provides the essential foundations for society. It must be managed as such, which requires understanding the interconnections between asset classes and risks. However, there is a lack of data about both the condition of existing assets and the performance of the infrastructure system in response to risks and challenges, like extreme climate events caused by climate change.

One of the real risks with infrastructure is cascading failures. The interconnected and inter-reliant nature of infrastructure systems amplifies the risk, cost and impacts of service failures. These networks also play a critical role in the emergency response to and recovery from events like extreme weather, compounding the issue.

The UK's Critical National Infrastructure assets are facing a combined threat from the effects of climate change, including weather events, and cyber and defence threats associated with an increasingly complex geopolitical environment. These threats must be considered in an integrated way.

The North Hyde Substation fire, which resulted in the closure of Heathrow airport in March 2025, demonstrated the fundamental importance of resilience across the UK's CNI assets. The National Energy System Operator's report into the incident highlighted lessons for UK government policy on resilience in the energy sector and other CNI sectors, including food and water security. These align with the steps set out in the government's Resilience Action Plan, which specifically recognises the impact of cascade failures and the need to develop the UK's knowledge base tool.

Question 2 – What national risks could have the most severe impact in a reasonable worst-case scenario, including nuclear accidents and loss of control of satellite communications?

Climate change is already happening with irreversible effects on the planet. More frequent and extreme weather events will place growing pressure on critical infrastructure systems, accelerating deterioration and increasing the risk of unpredictable failures.

The Climate Change Committee (CCC) anticipates that by 2050, the UK will face warmer, wetter winters, hotter, drier summers, and continued sea level rises. Sea levels, which have already risen by 16cm since 1900, could place a third of England's coastline at significant risk of flooding. Similarly, over a third of UK railway and road kilometres are currently at flood risk, and this is predicted to rise to around half by 2050.[1]

While the UK has been relatively aware of the impacts of flooding, other climate change-induced weather events, including heat waves and wildfires, are less well understood. In 2022, the UK recorded the warmest year on record, with temperatures reaching over 40°, putting pressure on infrastructure and the people it serves. Extreme heat can disrupt infrastructure systems via rail buckling and power line sagging.

[1] Climate Change Committee (2025) Progress in adapting to climate change: 2025 report to Parliament

The impacts of climate change and weather events should not simply be measured by their impacts on assets themselves. The economic and human impacts of climate change need to be front and centre in understanding the nature of the threat. Rising drought risk will increasingly put water supplies under pressure each summer. In 2022, a fifth of hospitals in the UK cancelled elective surgeries as a result of a heatwave.[2] Climate change is also a challenge to economic prosperity and sustainable long-term growth. As the CCC notes, unchecked climate change could impact UK economic output by up to 7% of GDP by 2050. The CCC has also called adapting to the physical risks of climate change a prerequisite for delivering net zero, noting that emission reduction plans that do not account for adaptation risk being less effective or more costly otherwise.[3]

Despite the risks, the CCC has highlighted a lack of progress in responding to climate change, warning that adaptation efforts in the UK have been wholly inadequate.[4]

Question 5 – How can a shared vision be developed to improve preparedness and resilience across the whole of society?

Responding to the threat of climate change will require a fundamental shift in governance, with clear leadership and coordinated policy that crosses the traditional silos of government departments. The present approach of coordinating climate adaptation via the Department for Environment, Food and Rural Affairs (Defra) is not working. Defra has failed to make climate adaptation a top priority within the department or in other central government departments. It is still not sufficiently resourced, particularly in local government.

All departments must engage with adaptation and resilience and recognise the challenges that climate impacts can have across multiple sectors at any one time. Tracking climate resilience across all government infrastructure spending would be a step in the right direction.

More broadly, while the UK has benefitted from cross-party consensus on the threat of climate change and the broad policy architecture required to respond to it (encapsulated by the Climate Change Act 2008), this agreement has splintered.

Public engagement

The public also needs to be more meaningfully engaged in the benefits of investing in infrastructure resilience and adaptation. In 2024, polling by Opinium commissioned by the ICE indicated that 62% of the public think that information about major infrastructure projects is not being effectively communicated to them. Public engagement serves many purposes. An awareness of the benefits an asset can deliver can shift public perception away from cost and time metrics and towards outcomes that are achieved via investment in infrastructure.

However, public engagement must be done well, and the commitment to delivering those benefits must be realised. The ICE has recommended that NISTA and the Chief Secretary to the Treasury (CST), who has responsibility for the 10-Year Infrastructure Strategy, should more meaningfully engage the public on the benefits of infrastructure investment, including in climate resilience and adaptation, and the necessary trade-offs that will inform programme prioritisation.[5] When trade-offs are required between departmental or sectoral interests, NISTA and the CST will have

[2] University of Birmingham (2023) 2022 heatwave struck off surgeries in a fifth of UK hospitals
[3] Climate Change Committee (2024) Progress in reducing emissions: 2024 report to Parliament
[4] Climate Change Committee (2025) Progress in adapting to climate change: 2025 report to Parliament
[5] ICE (2025) ICE policy paper: why do major projects take so long and cost so much?

important roles in advocating for the broader outcomes investments are seeking to deliver, as well as continuing to make the public case for the wider infrastructure system.

Question 6 – How can understanding of preparedness and resilience be improved, with action encouraged at all levels of society so that these priorities are both seen as relevant and achievable in practice?

See response to question 5.

Question 11 – What barriers have there been to implementing improvements to preparedness and resilience, such as inaction, inappropriate structures, inadequate funding, and short-term thinking?

The solutions to effective climate adaptation and resilience lie, in part, in better data on the likely impacts of climate and weather events, better ownership of the problem by asset owners, a complete understanding of the economic value of climate resilience and adaptation and an effective strategy for change, including one that works with nature and its capacity for natural restoration. Barriers that have held back implementation of this approach include:

1. Policy frameworks

The UK needs clear, actionable resilience and adaptation targets and a well-defined vision for what a resilient UK looks like in its National Adaptation Programme to move from restating plans to urgent action and delivering outcomes at pace.

The UK's current National Adaptation Programme (NAP3) for 2023–2028 was published in 2023 and set out priorities, including building resilient infrastructure. However, while it introduced some positive measures, like the Climate Resilience Board and changes to the Adaptation Reporting Power (ARP), NAP3 lacks enough urgency and has been ineffective in driving the critical shift towards effective delivery of adaptation. The current UK government has signalled it would strengthen climate resilience efforts, but it is still not moving fast enough.

The UK resilience framework has also lacked a well-defined vision for what a resilient UK looks like, including targets and standards for the desired level of national, local or sectoral resilience. The CCC is currently preparing a well-adapted UK report alongside its independent assessment to inform the Fourth UK Climate Change Risk Assessment, which will form the basis of the fourth NAP covering 2028-2033.

The ICE also recommends that National Policy Statements (NPS) should include a list of climate hazards and desired standards of protection for selected climate scenarios. In general, nationally significant infrastructure projects take into account flood risk and the impact of climate change on it, but other climate hazards are not always assessed. It was encouraging to see mention of work to map and develop further resilience standards in the 10 Year Infrastructure Strategy. This would be supplemented well by additional detail in NPSs.

2. Investment

The threat of climate change has been amplified by a lack of proactive investment in built and non-built solutions. Historically, there has been underinvestment in maintenance, which means infrastructure systems are not as resilient as they could be. Policy uncertainty has also deterred private investment and risk-taking to develop new engineering solutions and technologies. The nature and scale of climate change and its effects on weather in the UK are already substantial, pressing, and only going to worsen, making it cheaper and safer to be proactive and invest up front.

This will require a proportionate response targeting investment where it will have the greatest impact – it is unrealistic to immediately adapt every piece of the infrastructure system in every location. Infrastructure owners and operators will need to manage public expectations about the disruption brought on by climate change.

To incentivise investment, the ICE has recommended that the UK Government undertake a national review of the economics of adaptation to understand the value it provides. One of the challenges with making infrastructure climate resilience and adaptation a priority is that it does not have a market value. Currently, it is not measured or rewarded. In addition, it is not clear how the regulatory framework which sets out the parameters for funding these investments values resilience.

The ICE will be undertaking work in 2026 to set out how this review could be undertaken. A clear understanding of the economics of adaptation and the reality of a counterfactual where nothing is done would also support improved community engagement and strengthen the narrative around climate investment.

3. Data collection and sharing

More and better data collection and sharing are needed to improve understanding of asset-level resilience and the nature of potential cascading failures across asset classes. The ICE has recommended making adaptation reporting mandatory under the UK Climate Change Act for all infrastructure owners and operators.[6]

The information collected would fill in data gaps and help identify the most urgently needed adaptation measures. Mandating quantitative assessment, including financial quantification of expected damages/losses or impacts in a 'do nothing' scenario, would focus resilience efforts on the most material risks.

To ensure that information regarding asset status is shared and made available to the relevant parties, Defra, under the remit of the Adaptation Reporting Power (ARP), should have the authority to oversee standards of protection for key infrastructure that would be relevant at a systems level and to address concerns around data-sharing by providing equal access.

This would ensure that owners and operators have the information and data they need on the resilience of the infrastructure their assets depend on to provide contingency and protect them from extreme weather events. It would also provide a clearer picture of how infrastructure works as a 'system of systems'. The government can only plan effectively for future resilience challenges if they have a complete picture of how the UK's infrastructure systems are linked.

4. Design standards

Key infrastructure systems, including sanitation, water, flood defences, health, transport, communications and energy, will be increasingly vulnerable if design standards do not account for changing climate conditions. The government must move faster to put in place clear, measurable resilience standards.

The UK's infrastructure system was designed for the needs of a country facing different and less severe weather and climate events, and, while some new infrastructure is being built to withstand extremes, this requires a consistent approach, while existing assets must be adapted to deal with known climate threats and new extreme weather events. Well-timed and designed infrastructure interventions make communities more able to respond to climate events or avoid their impacts altogether.

[6] ICE (2023) ICE policy position statement: How can the UK's infrastructure system be made more climate resilient?

The recent Water White Paper confirms resilience standards for water assets are in development, but did not set a timeline. The government should also build on this to embed resilience as a core test for all spending across departments and public investment proposals.

Climate adaptation will need to be part of the standard design approach to engineering in order to bake it into the full swathe of infrastructure development. The ICE and the British Standards Institution are developing a publicly available specification (PAS) on climate adaptation pathways. Mandating the use of guidance such as the upcoming PAS presents an opportunity to embed climate resilience into business-as-usual infrastructure delivery.

5. Land use planning

Interdependencies between infrastructure systems and climate risks need to be better reflected in land use planning. For example, a lack of focus on the interdependencies between heat waves, wildfires and water quality is a challenge to water security. In the United States, there has been work to understand the impact of increased demand on the water network to fight wildfires, as well as the impact of ash on reservoirs and resulting water quality.

In March 2026, DEFRA published a new Land Use Framework, detailing how it will use land more effectively to increase the resilience of homes, communities, infrastructure, and food systems, while speeding up development and restoring nature. The framework responds to evidence that current land use is fragmented and inefficient, leading to perceived trade-offs between competing priorities. It concludes that these trade-offs can be reduced through better data, spatial planning, and more multifunctional use of land.

6. Nature-based solutions

The ICE has long advocated for the use of nature-based solutions to strengthen climate adaptation and resilience. While nature-based and nature-positive solutions are being implemented globally, this is often in isolated pockets. They have not yet become part of the systemic approach to infrastructure planning. This has resulted from a range of challenges, including:

- A lack of understanding from policymakers and the public of the benefits and outcomes of nature-based solutions.
- Regulatory barriers – for example, Part O of the English building regulations does not accept green infrastructure, such as living walls and green roofs, as a way to mitigate overheating in homes, meaning there is no incentive for developers to consider it in their housing projects.
- A patchy, location-specific evidence base that breeds low confidence from key actors such as regulators.
- A siloed approach to delivering infrastructure and infrastructure services, resulting in conflicting approaches to nature-based solutions and no clear direction on how to best integrate them into strategic infrastructure planning and prioritisation.[7]

In the UK, there are 4.6 million properties at risk from surface water flooding, which occurs when heavy rainfall overwhelms drainage systems. Implementing Schedule 3 of the Flood and Water Management Act 2010 in England would make sustainable drainage systems (SuDS) mandatory in all new developments. SuDS are environmentally friendly techniques to help manage and control surface water runoff close to where it falls.

[7] ICE (2024) ICE presidential roundtable: How can governments incorporate nature based solutions in their infrastructure systems?

However, while the government 'recognises the importance' of SuDS and the need to increase their uptake, it thinks this could happen through its ongoing planning policy reforms and by exploring other options to strengthen adoption and maintenance, rather than implementing Schedule 3. There will be a further consultation before it decides which course to pursue. In the meantime, without Schedule 3 to clearly assign responsibility or identify funding, the use of SuDS will remain inconsistent.

Question 13 – What lessons concerning preparedness and resilience can the UK learn from other countries, including Nordic countries, and how can it facilitate international co-operation on these issues?

Worldwide, it is increasingly clear that climate resilience is not a 'nice to have' but a core requirement for national security, economic stability, and public confidence. Governments are structuring their policies, institutions, and governance systems to tackle infrastructure climate resilience. The following examples highlight successful frameworks. For more information, please see the ICE's insights paper on how governments are structured to tackle infrastructure climate resilience.[8]

The Netherlands' Delta Programme – a model for flood defence

In the Netherlands, in addition to the Ministry of Infrastructure and Water Management, the government established an independent Delta Commissioner to lead the Delta Programme. This nationwide long-term strategy is aimed at safeguarding the country against the escalating risks of climate change, particularly flooding. The position of Commissioner is legally anchored in the 2012 Delta Act, and the Commissioner is responsible for the programme development, working closely with the ministries, provincial and municipal authorities, regional water boards, the business community, social organisations and the public. The Commissioner's duties include providing advice to Cabinet members, which ensures continuity and coordination beyond political cycles; this role also requires presenting a Delta plan annually to Parliament, along with the budget of the Ministry of Infrastructure and Water Management.

The Delta Programme also takes a long-term view. It focuses on the period up to 2050, with a forward view to 2100. While some measures are designed to last for the next 50 to 100 years, the programme highlights flexibility to incorporate new solutions.

The Netherlands was also the first country to establish a national risk-based flood standard. This standard assesses both the likelihood of a flood and its potential impact. The probability of failure for flood defences varies from 1/300 per year to 1/100,000 per year, depending on population density, the presence of critical infrastructure, and the potential for damage from a flood. For example, a levee section in a rural area might be designed to have a 1/300 annual probability of failure, while a levee section protecting a major city centre might have a much lower probability of failure, such as 1/100,000. This approach ensures that areas with higher consequences of failure or critical infrastructure receive more stringent protection.

Queensland Reconstruction Authority (QRA) – a model for a centralised authority and achieving value for money

Queensland is one of Australia's most climate-exposed states, where climate change intensifies bushfires, floods, cyclones, storms, and heatwaves. The Queensland Reconstruction Authority (QRA) is a statutory authority charged with managing and coordinating the Queensland Government's programme of infrastructure renewal and recovery within disaster-affected communities, with a focus on working with the state and local governments to deliver best

[8] ICE (2025) ICE insights paper: how are governments structured to tackle infrastructure climate resilience?

practice administration of public reconstruction and resilience funds. As of 2024, it has administered a programme of works valued at over AUD$23.7 billion.

QRA's approach has evolved from one of reactive recovery to one that emphasises 'building back better' and enhancing resilience. The Queensland Betterment Fund has enabled local councils to upgrade infrastructure to a more resilient standard. It has approved over 750 projects across 70 local government areas, with a total value exceeding AUD$533 million. This fund has shown that investing in resilient infrastructure upfront can result in substantial savings by avoiding reconstruction costs.

To ensure recovery spending delivered lasting benefits, QRA introduced a Value for Money Strategy that evaluated projects not only on cost but also on resilience, effectiveness, and community outcomes. Complementing this, QRA used the Sustainable Asset Valuation initiative tool (SAVi) to quantify the long-term social and economic value of climate-resilient infrastructure investment.

The QRA's approach offers an example of centralisation of recovery and resilience efforts at the state level, providing greater coordination and certainty over co-funding levels between local councils and the central government.

Singapore and Germany – coordinating a whole-of-government approach

Some countries, such as Singapore, have established a centralised body to oversee both adaptation and mitigation efforts. The National Climate Change Secretariat (NCCS), under the Prime Minister's Office, develops and implements domestic policies both in the mitigation and adaptation space, and works with sectoral agencies, like the Public Utilities Board, to mainstream resilience in a top-down approach. It also functions under the Inter-Ministerial Committee on Climate Change, which brings together key ministers to enhance whole-of-government coordination.

A whole-of-government approach is essential as adaptation challenges often lie outside the remit of a single agency. Similar to Singapore, cooperation among German ministries takes place in the Interministerial Working Group on Adaptation to Climate Change (IMAA), under the lead of the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection. This ensures that the Climate Adaptation Strategy, which includes the infrastructure cluster, is aligned with other federal strategies, like the Water Strategy.

Denmark – a global leader in local climate adaptation governance

Denmark is the first country in the world where every municipality has created a Local Climate Plan. This was made possible by the DK2020 Project, which started in 2019. It was led by the group Realdania and supported by C40 Cities. The project began with just 20 municipalities, but with help from Local Government Denmark and the five Danish regions, it grew to include all 98 municipalities across the country.

A strong support system was set up to help local areas plan for climate action. Municipalities worked closely with regional governments, while national organisations helped coordinate the project and shared easy-to-use technical advice. Local governments also involved the public by creating climate councils and holding workshops to hear from residents.

The Local Climate Plans include targets and actions on mitigation and adaptation, including flood-risk mapping, and set priorities for local adaptation measures. One of the learnings from the project is the importance of regional collaboration with other municipalities to ensure coordinated regional infrastructure. Denmark is now furthering its climate commitment through the LIFE ACT project, aimed at monitoring and implementing climate action plans, assisting municipalities in translating plans into actions and capacity building.

Miami Forever Bond – a pioneering example of financing infrastructure climate resilience through local innovation

In late 2017, Miami residents approved the US$400-million Miami Forever Bond to fund five major categories of infrastructure improvements to enhance the city's defences against climate change, particularly sea-level rise and increased flooding. The city has been able to fund numerous adaptation projects, including pump stations, raised roadways and improved stormwater management.

The Bond programme is being executed in three phases: immediate impact, gain momentum and long-term solutions. A Citizens Oversight Board oversees project management and progress reporting, complementing the standard oversight provided by the City Commission, to ensure transparency and accountability.

The Forever Bond structure utilises a municipal revenue bond to finance climate-related infrastructure projects. It spreads the cost over several decades, aligning payments with the long-term benefits – such as flood protection and sea-level rise adaptation. This approach helps manage costs over time, while matching the lasting value of the investments.