



House of Commons  
House of Lords

Joint Committee on the  
National Security Strategy

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# Readiness for storms ahead? Critical national infrastructure in an age of climate change

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**First Report of Session 2022–23**

*Report, together with formal minutes relating  
to the report*

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## The Joint Committee on the National Security Strategy

The Joint Committee on the National Security Strategy is appointed by the House of Lords and the House of Commons to consider the National Security Strategy.

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### Powers

The Committee has the power to require the submission of written evidence and documents, to examine witnesses, to meet at any time (except when Parliament is prorogued or dissolved), to adjourn from place to place within the United Kingdom, to appoint specialist advisers, and to make Reports to both Houses. The Lords Committee has power to agree with the Commons in the appointment of a Chairman.

## **Publications**

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## Summary

The UK's CRITICAL national infrastructure (CNI)—true to its name—is fundamental to the smooth-running of the economy and of society. It is also very vulnerable to extreme weather and other effects of climate change, such as sea level rises. Major power outages, landslides onto roads, buckling train lines and flooding of infrastructure sites: these are all realistic scenarios, and can lead to 'cascading' risks affecting other CNI sectors. Different infrastructure sectors are highly interdependent, so the shutdown of one CNI operator may cause knock-on effects on multiple other sectors.

This was illustrated starkly by Storm Arwen last November, when major power outages left some people without access to their digital land lines, and no way of contacting emergency services. Separately, a recent problem with railway drainage almost caused the National Blood Bank to flood. These examples show that poor adaptation to climate change is a major threat to the UK's national security and prosperity.

As in our previous reports in this Parliament, we have unfortunately uncovered an extreme weakness at the centre of Government on a critical risk to the UK's national security. Instead of making the resilience of CNI a priority, the then Minister for the Cabinet Office—self-described as the Minister for CNI resilience—simply refused to give oral evidence to us on this topic, despite having submitted two pieces of written evidence. This acknowledgment of his lack of command of this issue—the reason given for his refusal—was in itself shocking, and suggests a severe dereliction of duty on the part of the Government. It appears that no Minister is taking responsibility for this topic, and there are no cross-Cabinet Committees driving forward the Government's work on adaptation and CNI resilience. This may be why the Government has accepted the Climate Change Committee's finding that it is moving backwards on adaptation, and has failed to implement any of that Committee's latest adaptation recommendations in full. It is hard to imagine the Government taking such a lax approach to any other recognised national security risk.

The Government seems to have accepted that the next National Adaptation Programme (NAP) needs to be much more ambitious, and we implore Ministers to get a proper grip on this issue. Clear Ministerial responsibility for CNI resilience, as such, should be identified; regular meetings with the Defra Minister for Climate Adaptation should also occur, to ensure that the NAP drives forward a strong programme of activity to enhance CNI resilience to climate change.

The National Resilience Strategy has been delayed repeatedly and has still not been published, despite being a key commitment of the Integrated Review, over 18 months ago. The new Prime Minister must waste no time in laying out the Government's plans to make the UK much more resilient to the shocks that are becoming a reality of the uncertain times in which we live. To support this work, she should also re-establish a dedicated Ministerial committee on resilience.

Despite the major risks that we outline, there are no formal mechanisms for collaboration or information-sharing between CNI sectors, and regulation is happening in siloes. We therefore call on the Government to use a range of mechanisms to improve collaboration on interdependencies and to improve its oversight of adaptation and resilience,

including establishing a statutory forum for CNI regulators on climate adaptation, establishing clear resilience standards for CNI operators, and setting up a programme of stress testing CNI against extreme weather and other effects of climate change. The Government should also ensure that all operators have access to high quality weather, climate and impact forecasting and modelling, via the Cabinet Office's Situation Centre.

Local resilience forums (LRFs) are essential to the local response to extreme weather events, so we welcome the Government's recognition that they have been underfunded. The Government's ongoing LRF reform programme should consider specifically their role in overseeing local CNI vulnerabilities to extreme weather and other effects of climate change, including the likely impact locally of extreme weather events. The Government should also establish a much clearer statutory remit for LRFs, and set up a programme of 'exercises' to plan for major regional extreme weather events with multiple cascading effects.

Investment in adaptation can save money later on, so it is vital that the Government's planned acceleration of infrastructure investment does not result in lower standards of adaptation. We also recommend that the Government undertakes a more detailed cost-benefit analysis of climate adaptation for every CNI sector, and engages with insurance providers to explore options for a public-private insurance partnership, to incentivise investment in climate adaptation measures.

These actions must be taken urgently. The costs of failure are extremely high, as demonstrated by the tragic rail accident near Stonehaven in 2020, caused by debris on the track after heavy rainfall. This summer's heatwave also showed that even unimaginable scenarios can fast become a reality, and the Government must prepare for the worst.

# 1 Introduction and context

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## Climate change impacts

1. There is overwhelming evidence that the effects of climate change are already with us. The country experienced an unprecedented heatwave this summer, with a record-high temperature of 40.3°C.<sup>1</sup> The last decade was the warmest on record,<sup>2</sup> and the UK's average land temperature has increased by about 1.2°C from pre-industrial levels. Even under the policies currently committed to by global institutions and nation states, the Earth's mean temperature is still projected to reach around 2.7°C above pre-industrial levels by the end of the century.<sup>3</sup> To put this in perspective, the global temperature only rose by around 4 to 5°C during the 7,000 years after the end of the last ice age; in the past century, the temperature has climbed at ten times the rate of average warming during ice age recovery.<sup>4</sup>
2. In recent years, there have been extreme weather events in the UK that the Met Office would not have expected without climate change,<sup>5</sup> and even more severe effects will be prevalent by the end of this century, including droughts, wildfires and floods.<sup>6</sup> The UK saw six major storms over the past year, including some of the highest wind speeds recorded in over 30 years.<sup>7</sup> Looking ahead to 2050, the independent Climate Change Committee (CCC) anticipates that the country will experience warmer and wetter winters, drier and hotter summers, and continued sea level rises.<sup>8</sup> Sea levels have increased by 16cm since 1900; by 2050, about a third of England's coast will be under pressure from flood risks.<sup>9,10</sup>
3. The impact of these changes on the UK's critical national infrastructure (CNI) is all too clear. In recent years, wind and flooding have had a significant effect on the UK's railways, accelerating asset deterioration and increasing the likelihood of "critical coping thresholds" for railway operators being exceeded, such as on rail temperatures or drainage capacity.<sup>11</sup> UK telecoms is at risk from "all types of flooding, high winds, and lightning strikes",<sup>12</sup> and our energy supply can be disrupted by a range of severe weather events, particularly storms. Without further investment in water storage or transfer infrastructure, along with action to reduce demand, there is a one in four chance of severe drought before 2050.<sup>13</sup> Additional "cascading" risks—spreading from one CNI sector to another, magnifying the impact of an event—were demonstrated vividly by the effects of Storm Arwen in late 2021, which led to extended power and communication outages; the summer heatwave also caused power cuts and transport disruptions. We are likely to see further effects on UK CNI in the next two decades, some of which are summarised in Box 1.

- 
- 1 Met Office news item, [Record high temperatures verified](#), 28 July 2022
  - 2 United Nations Climate Action, [What is climate change?](#), accessed 26 September 2022
  - 3 Climate Action Tracker website, ["Temperatures: Addressing global warming"](#), accessed 26 September 2022
  - 4 The Royal Society website, ["Climate is always changing. Why is climate change of concern now?"](#) Last updated March 2020; and NASA Earth Observatory website, [How is Today's Warming Different from the Past?](#), 3 June 2010
  - 5 Met Office written evidence ([NIC0013](#))
  - 6 Met Office official blog, [Extreme events on the increase in a changing climate](#), 25 March 2022
  - 7 Met Office website, [UK storm season 2021/22](#), accessed 26 September 2022
  - 8 Climate Change Committee, [Progress in adapting to climate change: 2021 Report to Parliament](#), June 2021
  - 9 Climate Change Committee news item, [UK struggling to keep pace with climate change impacts](#), 16 June 2021
  - 10 *BBC News*, Climate change: [Rising sea levels threaten 200,000 England properties](#), 15 June 2022
  - 11 Network Rail written evidence ([NIC0012](#))
  - 12 TechUK written evidence ([NIC0025](#))
  - 13 National Infrastructure Commission website, [Water & Floods](#), updated 22 September 2022

4. Witnesses to this inquiry called for a change in attitude towards CNi resilience to the changing climate. Instead of considering climate change as a gradual process, or even a predictable one, we should consider it to be “hugely volatile”, and appreciate that “what might seem impossible and even implausible can happen, and it can happen tomorrow”.<sup>14,15</sup> This was illustrated starkly by the summer heatwave: Mark Maslin, professor of Climatology at University College London, told the BBC that “this 40 degree heatwave was an unknown: I don’t think any of us would have put any money on there being a 40 degree heatwave in the British Isles within this decade”.<sup>16</sup> Climate change could also be accelerated significantly by a number of key ‘tipping points’ (see Box 2), such as ice sheet collapse and abrupt ocean circulation changes.<sup>17</sup>

**Box 1: Key infrastructure vulnerabilities**

The Adaptation Committee of the Climate Change Committee has highlighted the following vulnerabilities of critical national infrastructure to climate change:

- Flooding is set to become more frequent and severe, affecting infrastructure including energy, transport, water, waste and digital communication.
- Projected extended periods of rainfall will also increase the risk of slope and embankment failure: approximately 8% of the UK’s transport network is at medium to high risk of landslide disruption.
- Changes in rainfall, combined with population growth, will lead to supply-demand deficits in some water resource zones by the 2050s, with widespread deficits by the 2080s.
- High temperatures can cause “railway tracks to buckle, electricity cables to sag, signalling equipment to overheat and fail”, and “road tarmac to soften and rut”.
- Increases in maximum wind speeds during storms are likely to have “significant implications for overhead power lines, data network cabling and the rail network, as well as for offshore infrastructure and wind turbines”.<sup>18</sup>

14 [Q91](#)

15 [Q6](#) (Dr Swenja Surminksi)

16 BBC Radio 4, [The Briefing Room: Adapting to a hotter Britain](#), broadcast 30 July 2022

17 Armstrong McKay et al, [Exceeding 1.5°C global warming could trigger multiple climate tipping points](#), Science Magazine Vol 377, Issue 6611, 9 September 2022

18 Climate Change Committee, [Progress in adapting to climate change: 2021 Report to Parliament](#), June 2021

**Box 2: Climate tipping points**

The Intergovernmental Panel on Climate Change (IPCC) defines a tipping point as a “critical threshold beyond which a system reorganizes, often abruptly and/or irreversibly”.<sup>19</sup> Academics have concluded that exceeding 1.5°C global warming (above pre-industrial levels) could trigger key climate tipping points.<sup>20</sup> These include:

- **Ice collapse:** the Amundsen Sea embayment of West Antarctica may already have passed a tipping point. When it collapses, it could destabilise the rest of the West Antarctica ice sheet and cause a three-metre sea level rise, on a timescale of centuries to millennia.<sup>21</sup>
- **The Amazon rainforest:** a tipping point could be caused by 20–40% of deforestation in the Amazon, resulting in abrupt carbon release back into the atmosphere and amplified climate change. Around 17% of the rainforest has been lost since 1970.<sup>22</sup>
- **AMOC shutdown:** the Atlantic Meridional Overturning Circulation (AMOC) is a key aspect of ocean heat and salt transport, and plays a critical role in regulating the global climate. Shutdown or excessive slowdown would have widespread effects, including plummeting temperatures in the Northern hemisphere. AMOC shutdown in the 21st century is unlikely, but is still considered a “plausible” scenario.<sup>23</sup>
- **Global cascade:** a global cascade of multiple tipping points could lead to a new, ‘hothouse’ climate state. If we exceed tipping points in one system, it can increase the risk of crossing them in others: ice sheet melting, for example, has contributed to a 15% AMOC slowdown since the mid-20th century.<sup>24</sup>

**The adaptation deficit**

5. Critical national infrastructure (CNI) is vital to the smooth functioning of the economy and society, and to the welfare of the general public. The Government recognises CNI vulnerabilities as a major national security risk, as the 2021 Integrated Review<sup>25</sup> makes clear:

“The UK can only maximise the benefits of our openness if we are strong and secure at home—ensuring that our citizens are safe from harm, while protecting our democracy, the economy **and the critical national infrastructure on which daily life depends.**”<sup>26</sup> [Emphasis added]

6. Despite this recognition, there is little dispute that UK CNI faces a major adaptation deficit, which is already affecting its ability to provide essential services reliably. Under the

19 Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6), [Summary for Policy Makers](#), 2021

20 Armstrong McKay et al, [Exceeding 1.5°C global warming could trigger multiple climate tipping points](#), *Science* 377, 1171, 9 September 2022; and Lenton et al, [Climate tipping points — too risky to bet against](#), *Nature* magazine, 27 November 2019

21 *Ibid*

22 *Ibid*

23 Met Office Briefing Note, [The slowdown or shutdown of AMOC - a key regulator of global climate](#), September 2019

24 Armstrong McKay et al, [Exceeding 1.5°C global warming could trigger multiple climate tipping points](#), *Science* 377, 1171, 9 September 2022; and Lenton et al, [Climate tipping points — too risky to bet against](#), *Nature* magazine, 27 November 2019

25 HM Government, Global Britain in a Competitive Age: [the Integrated Review of Security, Defence, Development and Foreign Policy](#), March 2021

26 HM Government, Global Britain in a Competitive Age: [the Integrated Review of Security, Defence, Development and Foreign Policy](#), March 2021

2008 Climate Change Act, the Government lays an assessment of the risks to the UK from climate change before Parliament every five years—the Climate Change Risk Assessment (CCRA). The CCRA is based on an independent assessment of the available evidence on climate risks and opportunities, which is commissioned from the Adaptation Committee, a sub-committee of the expert Climate Change Committee. The Adaptation Committee’s last Independent Assessment, published in June 2021, found that the UK is not ready for even the best-case scenario of climate change, let alone the current trajectory, and that “the gap between the level of risk we face and the level of adaptation underway has widened” since its last report in 2017.<sup>27</sup> It identified eight areas in which the most urgent action is required, including “risks to people and the economy from climate-related failure of the power system”. The Chair of the Adaptation Committee, Baroness Brown, described adaptation as “the Cinderella of climate change” compared with mitigation: “under-resourced, underfunded and often ignored”.<sup>28</sup>

7. The Government fully accepted the Adaptation Committee’s findings, concluding that “we must go much further and faster to truly prepare for the impacts of a warmer world”, and recognising that “in the majority of risk areas we need to take more action”. The Government’s CCRA also described the financial cost of infrastructure risks to the UK economy by 2050 as “very high” in a 2°C global warming scenario—the most severe category, meaning that the economic costs will be over £1billion per annum.<sup>29</sup> Based on the evidence outlined in this report, the real costs will be higher still without further Government action.

8. There are two important policy frameworks in development over the coming months, both of which are highly pertinent to this inquiry. First, the Government is currently developing its next National Adaptation Programme, which sets the actions that it (and others) will take to adapt to the challenges of climate change in the UK. In addition, it plans to publish its much-delayed National Resilience Strategy in the coming months. A sub-strategy of the Integrated Review, this promises to develop a new approach to preparedness and risk response: one which “fully recognises” that natural hazards and other risks can cause as much disruption to the UK’s core interests as conventional security threats.<sup>30</sup> Climate risks can also arise from more conventional threats, as demonstrated by the suspected sabotage of the Nord Stream I pipeline from Russia to Europe. The resulting methane leaks were estimated to be equivalent to the annual emissions from a city the size of Paris.<sup>31</sup>

9. This report will recommend actions that we regard as essential to improve UK infrastructure’s resilience to the changing climate. For the most part, we are not prescriptive about the policy framework under which these reforms need to occur, whether part of the National Resilience Strategy, the National Adaptation Programme, or as part of wider regulatory reforms. What we *are* clear about, however, is the urgency of the task at hand.

**10. The evidence is overwhelming that the effects of climate change on our critical national infrastructure are already significant, and are set to worsen substantially**

27 Climate Change Committee, [Independent Assessment of UK Climate Risk: Advice to Government for the UK’s third Climate Change Risk Assessment \(CCRA3\)](#), June 2021

28 *The Guardian*, [UK failing to protect against climate dangers, advisers warn](#), 16 June 2021

29 HM Government, [UK Climate Change Risk Assessment 2022](#), 17 January 2022

30 HM Government, *Global Britain in a Competitive Age: the Integrated Review of Security, Defence, Development and Foreign Policy*, March 2021

31 *New Scientist*, [Nord Stream pipes leaked ‘enormous’ amount of methane into atmosphere](#), 4 October 2022

**under all reasonable climate change scenarios. Buckling train lines, flooding of major infrastructure sites, landslides and power outages are all realistic outcomes. They may also happen simultaneously, causing multiple cascading effects across different infrastructure sectors. The scale of the challenge facing Government, operators and regulators is clear: there is an urgent need to adapt our infrastructure to the potentially rapid effects of climate change.**

## Definitions and terminology

11. The Centre for the Protection of National Infrastructure (CPNI) defines CNI as “those facilities, systems, sites, information, people, networks and processes, necessary for a country to function and upon which daily life depends”. UK CNI is defined as consisting of 13 sectors: chemicals, civil nuclear, communications, defence, emergency services, energy, finance, food, Government, health, space, transport and water.<sup>32</sup> In light of the evidence received during this inquiry, this report focuses predominantly on energy, communications, transport and water. We considered CNI resilience to the changing climate in the short, medium and long term (two years, five years and 20+ years, respectively).

12. We draw on the definitions of ‘adaptation’ and ‘resilience’ provided by the Intergovernmental Panel on Climate Change’s (IPCC’s) Working Group 2’s sixth assessment report (AR6):

“Adaptation is defined, in human systems, as the process of adjustment to actual or expected climate and its effects in order to moderate harm or take advantage of beneficial opportunities.”<sup>33</sup>

13. AR6 defines resilience as:

“[...] the capacity of social, economic and ecosystems to cope with a hazardous event or trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure [...] while also maintaining the capacity for adaptation, learning and transformation.”<sup>34</sup>

14. Broadly speaking, climate adaptation efforts should have the effect of enhancing CNI resilience to extreme weather events and other effects of climate change, such as sea level rises. Wider resilience efforts may have a positive effect on CNI’s ability to respond to withstand other threats and hazards too, such as cyber or terrorist attacks.

## This Committee and our inquiry

15. The Joint Committee on the National Security Strategy (JCNSS) was established in 2010, with a primary function to “consider the National Security Strategy”. Since then, we have fulfilled this task by scrutinising:

32 CPNI website, “[Critical National Infrastructure](#)”, accessed 26 September 2022

33 Intergovernmental Panel on Climate Change (IPCC), [Climate Change 2022: Impacts, Adaptation and Vulnerability](#), p.7, footnote 10, 28 February 2022

34 Intergovernmental Panel on Climate Change (IPCC), [Climate Change 2022: Impacts, Adaptation and Vulnerability](#), p.7, footnote 12, 28 February 2022

- Cross-government national security strategies, the process by which they were created, and the resources allocated to their delivery;
- Discrete policy areas within those strategies; and
- The structures for Government decision-making on national security—particularly the role of the (now disbanded) National Security Council (NSC), the National Security Adviser (NSA) and the National Security Secretariat in the Cabinet Office.

16. In November 2021, we launched an inquiry into “critical national infrastructure and climate adaptation”, examining adaptation as a national security issue. We sought evidence on the resilience to climate change of the infrastructure on which day-to-day life in the UK depends, including the effectiveness of Government policy, legislation and implementation frameworks at managing national security risks arising from climate change. We also sought to examine specifically the role of the forthcoming National Resilience Strategy, particularly in addressing opportunities for (and obstacles to) improved resilience among CNI operators.<sup>35</sup> We launched this inquiry before Russia’s second invasion of Ukraine in February 2022, so it was not a reaction to the subsequent pressures placed on UK energy resilience. The war has nevertheless shone a light on some of the critical weaknesses of our energy infrastructure, which we consider in Chapter 2.

17. We received over 40 pieces of written evidence from a wide range of stakeholders, and conducted an online survey of infrastructure operators from February to April 2022. We held six oral evidence sessions between December 2021 and July 2022, hearing from academic experts, regulators, CNI operators and Government representatives. In May 2022, we visited the Met Office’s headquarters in Exeter. We also benefited from the expert advice of a Specialist Adviser appointed for the duration of this inquiry—Professor Suraje Dessai, Professor of Climate Change Adaptation at the University of Leeds<sup>36</sup>—and from the expertise of our four existing Specialist Advisers.<sup>37</sup> We are grateful to all those who contributed to this inquiry.

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35 JCNSS call for evidence, [Critical national infrastructure and climate adaptation](#), November 2021

36 Professor Dessai declared the following interests: Champion of the Strategic Priorities Fund UK Climate Resilience Programme; Member of the National Infrastructure Commission Advisory Panel on Climate Resilience; Member of Elsevier’s Climate Advisory Board; Member of the European Scientific Advisory Board on Climate Change; Member of the Joint Programming Initiative – Climate Transdisciplinary Advisory Body; Associate editor of *Climate Risk Management* (Elsevier); Co-Editor-in-Chief of *Climate Risk Management* (Elsevier, until April 2021); Member of the Editorial Advisory Panel in Social Science and Policy for *Nature Climate Change*; paid consultancy for Defra (October 2022), reviewing documents linked to the third National Adaptation Programme.

37 The four Specialist Advisers declared the following interests. Professor Malcolm Chalmers: Deputy Director-General, Royal United Services Institute. Professor Michael Clarke: Visiting professorship at King’s College London (Department of War Studies); Honorary professorship at University of Exeter and Associate Director of its Strategy and Security Institute; Member of the Advisory Boards for Global Security Forum, Tellus Matrix and FAROS Foundation; Distinguished Fellow, Royal United Services Institute; Fellow, Royal College of Defence Studies; Consultancy with SC Strategy Ltd, Gray’s Inn; Partner of Riskology Global. Paddy McGuinness: Director and Founder of Hudhud Associates Limited; Founder of Oxford Digital Healthcare; Chair of Trustees, St Joseph’s Hospice Hackney; Member of the Oxford Board of the Oxford and Cambridge Catholic Education Board; Senior Advisor, Brunswick Group LLC; Strategic Partner, C5 Capital; Advisory Board, Glasswall Solutions; Advisory Board, KAZUAR Advanced Technologies Ltd; Advisory Board, Pool Reinsurance. Professor Sir Hew Strachan: Professor of International Relations at the University of St Andrews; Comité scientifique, Laboratoire de Recherche sur la Défense, IFRI, Paris; Consultant for the Global Strategic Partnership (a consortium led by RAND Europe), commissioned by the Development, Concepts and Doctrine Centre, Ministry of Defence; Patron, British Pugwash Group; HM Lord Lieutenant, Tweeddale; Ambassador for the HALO Trust.

18. This report considers first the interdependent nature of UK CNI, the need for operators and regulators to share information and intelligence across sectoral boundaries, and the resilience of the UK's energy supply, on which so many other sectors depend. Chapter 3 then considers the variety of resilience and adaptation standards in place for different CNI sectors, and the case for cross-sector resilience standards and mandatory stress testing. Chapter 4 covers ministerial oversight and cross-Government action on climate adaptation and resilience, and Chapter 5 considers the work of Local Resilience Forums. Our final chapter focuses on the funding of measures to boost resilience and adaptation.

**19. When we launched this inquiry, climate adaptation had been described as the 'Cinderella' of climate change, compared with climate mitigation and the path to net zero. Approaching the vital COP26 summit, we saw much-needed discussion about actions to decarbonise the UK economy and cut greenhouse emissions for the future, but little attention was paid to the effects of climate change already incurred. During the course of our inquiry, however, the UK experienced major weather events such as Storm Arwen, including extensive power outages and a knock-on effect on communications. We concluded our inquiry in the midst of an unprecedented heatwave, taking evidence from Government Ministers and officials while the country faced significant rail disruptions, flight delays and power cuts. These events have moved climate adaptation more firmly into the public eye and demonstrated that poor adaptation poses a threat to UK national security, but they have also shone a light on an alarming lack of Government action in this vital area.**

## 2 Key adaptation challenges: interdependencies and information-sharing

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20. On 26–27 November 2021, winds of up to 98mph battered the UK, causing significant damage and disruption. The unusual northerly winds contributed to the felling of thousands of trees, bringing down power lines in North East England and Scotland.<sup>38</sup> Almost a million customers lost power, with nearly 4,000 suffering outages for over a week;<sup>39</sup> twelve days after the storm, dozens of homes were reportedly still affected.<sup>40</sup> The impact was felt in more than one CNI sector: BT’s ongoing transition to digital phone lines, which are reliant on electricity, meant that some customers were left without access to communication, even for calls to the emergency services (see Box 3). Almost 300 military personnel were deployed to support the local response.<sup>41</sup>

21. Storm Arwen was a stark illustration of some of the dominant themes emerging from this inquiry: the strong interdependencies between different CNI sectors; the cascading risks generated by extreme weather events and other effects of climate change; and the lack of anticipation by key actors (for wind coming from an unanticipated direction, for example). This chapter considers some of those issues, including the current state of collaboration, cooperation and information-sharing between different CNI sectors.

### Key interdependencies between CNI sectors

22. In its Third Independent Assessment, the Adaptation Committee noted that extreme weather events can create “cascading risks” that spread across sectors, “with impacts an order of magnitude higher than impacts that occur within a single sector”, and it emphasised the particular dependence of other sectors on energy supply.<sup>42</sup> A number of witnesses also gave examples of major interdependencies between CNI sectors, highlighting the risks of cascading failures. For example:

- The Scottish Government commented that infrastructure systems “do not operate in isolation”,<sup>43</sup> and highlighted the dependence on energy supply of water and wastewater treatment systems, IT infrastructure, and signalling for roads and rail.<sup>44</sup> In turn, bridges may support cables and pipes carrying energy and water.<sup>45</sup>

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38 Met Office briefing, [Storm Arwen, 26 to 27 November 2021](#), 2 December 2021

39 Ofgem press release, [Ofgem publishes full report following six-month review into networks’ response to Storm Arwen](#), 9 June 2022

40 BBC News, [Storm Arwen: Power cut compensation posted to victims](#), 17 December 2021

41 [Answer to UIN 125099](#), 1 March 2022

42 Climate Change Committee, [Independent Assessment of UK Climate Risk: Advice to Government for the UK’s third Climate Change Risk Assessment \(CCRA3\)](#), June 2021

43 Scottish Government written evidence ([NIC0018](#)), point 5

44 Scottish Government written evidence ([NIC0018](#)), point 5

45 Scottish Government written evidence ([NIC0018](#)), point 5

- Anglian Water noted that the water sector depends on sectors such as chemicals, communications, energy and transport for their service delivery, whilst food sectors, energy producers (such as nuclear power stations) and oil refineries depend heavily on the water sector for production, processing and cooling.<sup>46</sup>
- The UK Energy Research Centre pointed out that, as well as an increasing reliance on electricity among other CNI sectors, any disruption to telecoms could impact on other CNI sectors (including energy), because operators increasingly use mobile or internet-based means to communicate with their staff.<sup>47</sup> In addition, energy, water and IT infrastructure are often co-located, meaning that weather-related power cuts can affect multiple sectors simultaneously.<sup>48</sup>

23. Professor Jim Hall, Professor of Climate and Environmental Risks at the University of Oxford, told us that individual operators understand their own networks “pretty well”, but have a “less clear picture” of the networks upon which they depend.<sup>49</sup> In Box 3, we outline the impact of Storm Arwen on BT’s ‘Digital Voice’ programme, which caused major communication disruptions for customers. Our survey respondents also described a number of recent near-misses and interdependencies. For example:

- A power station told us that it relies on water abstracted from a local canal, which fell below the required water level in 2021, reducing operations for two to three weeks.
- A water company reported that Storm Arwen led to power being lost from 140 wastewater sites, along with water treatment assets serving 17,500 properties, which were left without water.
- An energy company reported that the ‘Beast from the East’ in 2018 caused significant travel disruption, meaning that its engineers had trouble visiting gas sites to deal with technical faults.

24. Some interdependencies are less obvious, and thus more difficult to predict. Perhaps the most alarming ‘near miss’ that we encountered during this inquiry was the near-flooding of the National Blood Bank, which was highlighted by Network Rail:

“[...] there is a limit to what individual organisations or sectors can do to manage more strategic risks. For example, **the recent failure of one of our drainage systems nearly caused the National Blood Bank to flood.** Management of the culvert was within our power, but there is the more strategic issue of the centralisation of such an important facility versus a more diverse and potentially resilient model.”<sup>50</sup> [Emphasis added]

This highlights the vital importance of information-sharing between different infrastructure operators, and of national oversight of the UK’s most crucial CNI sites.

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46 Anglian Water written evidence ([NIC0029](#)), under 1b – interdependencies

47 UK Energy Research Centre written evidence ([NIC0010](#))

48 UK Energy Research Centre written evidence ([NIC0010](#))

49 [Q33](#)

50 Network Rail ([NIC0012](#))

**Box 3: Digital Voice**

Storm Arwen in November 2021 exposed a key interdependency between energy and communications providers. Phone companies intend to withdraw the existing analogue telephone system—the Public Switched Telephone Network (PSTN)—by 2025. By that date, landline telephone services should be provided by a digital network, and calls should be transmitted as data over the internet using “Voice over Internet Protocol (VoIP)” technology. The process is industry-driven, based on concerns that the PSTN is an aging network, which is becoming harder and more expensive to maintain.<sup>51</sup>

Witnesses to our inquiry highlighted the risks inherent to digital phone lines: they rely on mains power at the customer’s premises, meaning that customers were left without access to emergency calls in areas with poor mobile signal following Storm Arwen.<sup>52</sup> This followed criticism from columnist and comedian David Mitchell earlier that month, who jested that an appropriate slogan for Digital Voice might be: “Your home phone, only sometimes it won’t work”.<sup>53</sup> After the 7/7 terrorist attacks in London in 2005, public mobile communication networks were shut down in order to prioritise access by the emergency services, demonstrating the need for back-up solutions. It is unclear which parts of Government were sighted on the Digital Voice proposal before it was implemented—particularly those Ministers and officials concerned with the resilience of UK CNI.

In March this year, BT decided to pause all further switchovers to Digital Voice for customers “who don’t want to move to the new technology straight away”. The company added that it had “underestimated the impact that this technology upgrade could have for some of them, particularly those who lie in power cut-prone areas with poor mobile reception”. BT will restart the programme once it judges that it has “key products” in place to provide customers with more resilient connectivity.<sup>54</sup>

**Collaboration and information-sharing between CNI sectors**

25. The wide extent of CNI interdependencies points to the critical need for operators to share information with each other—either directly, through their regulators,<sup>55</sup> or via a central mechanism. As we will explore in further detail in Chapter 3, the UK has a ‘vertical’ model of CNI regulation: CNI sectors are operated and regulated separately, mirroring the system for departmental oversight (which we will address in Chapter 4). This results in a variety of approaches to climate adaptation, and a lack of formal connections between sectors. We pressed the Government on whether it had any specific, Department-hosted forums for regulators and/or operators to collaborate over climate adaptation measures, or to discuss interdependencies. It told us simply that “Each sector has its own fora and methods of engagement with industry to ensure cohesive threat and hazard preparedness”.<sup>56</sup>

26. The only relevant cross-sector forum that we encountered during our inquiry, and which was mentioned in the Cabinet Office’s written evidence, is the Infrastructure Operators Adaptation Forum (IOAF), which meets approximately three times per year. The IOAF includes infrastructure owners and operators,<sup>57</sup> and is coordinated by the

51 Ofcom, [The future of fixed telephone services: Policy positioning statement](#), 22 February 2019

52 Institution of Engineering and Technology ([NIC0008](#)), UK Energy Research Centre ([NIC0010](#)), techUK ([NIC0025](#))

53 The Observer (David Mitchell column), [It’s good to talk, unless you’re a BT customer](#), 14 November 2021

54 BT Plc ([NIC0045](#))

55 In a report last December, the Lords Risk Assessment and Risk Planning Committee noted “how interconnected many sectors are”, and concluded that “Cross regulator working is essential”, in light of the “cross-sector implications of many risks”. Source: House of Lords Risk Assessment and Risk Planning Committee, [Preparing for Extreme Risks: Building a Resilient Society \(HL110\)](#), 3 December 2021

56 Cabinet Office ([NIC0046](#)), point 8

57 Cabinet Office ([NIC0015](#)), point 33

Environment Agency, the Climate Change Committee and the National Infrastructure Commission—all three of which are independent or arms-length bodies—to share best practice on reducing vulnerabilities and on synergy between infrastructure systems.<sup>58</sup> It does consider infrastructure interdependencies, but its membership is purely voluntary.

27. A further potential tool for encouraging collaboration on interdependencies is the Adaptation Reporting Power (ARP). Granted under the Climate Change Act 2008, the Government has the power to “direct” certain bodies “with a function of a public nature” to provide information about the impact of climate change on their ability to function, report on their adaptation plans and timescales for action, and cooperate with other reporting authorities to produce their reports.<sup>59</sup> It is unclear whether the Government has ever made use of this joint-reporting power, despite its scope to enhance join-up and oversight over interdependencies. At the moment, it isn’t even making use of its power to compel organisations to report, having made it voluntary in the latest two rounds (2013 and 2018), refraining from even offering guidance about what reports should include. The Adaptation Committee has called for a return to mandatory reporting, and for the list of organisations to be expanded to ensure more comprehensive coverage of CNI.<sup>60</sup>

### ‘Systems thinking’ and the CNI Knowledge Base

28. Unanticipated, cascading effects of a crisis were a prominent feature of the Covid-19 pandemic. For example, the Government’s pandemic planning exercises had not predicted that schools would have to close, with teaching moving online; the central scenario involved a small number of schools taking the decision to close. Planners were therefore unable to consider the impact on the economy of parents being forced to home-school their children.<sup>61</sup> This illustrates the potential value of systems thinking, which is described by the Government Office for Science (GO Science) as “a framework for seeing the interconnections in a system and a discipline for seeing and understanding the whole system; the ‘structures’ that underlie complex situations”.<sup>62</sup>

29. Witnesses urged the Government to take a systems approach to climate adaptation and CNI resilience. The Institute of Engineering and Technology (IET) suggested that there should be a “body” that has responsibility for “the system of systems”, and recommended “regulatory oversight of the CNI as a whole. Similarly, Professor Hall hailed the benefits of developing “system models” that bring together different CNI sectors to model interdependencies, asserting that a “system-of-systems perspective provides you with a shared platform”, which infrastructure operators can then use to “develop a shared understanding of [...] where the critical interdependencies are” and “where they ought to be sharing more information”.<sup>63</sup>

30. The civil service is making some welcome progress in this space: GO Science has produced guidance on “systems thinking for civil servants”,<sup>64</sup> for example, as well as a

58 HM Treasury, [National Infrastructure Strategy](#) (CP329) p60, November 2020

59 [Climate Change Act 2008 \(legislation.gov.uk\)](#), sections 61–65

60 Climate Change Committee, [Progress in adapting to climate change: 2021 Report to Parliament](#), June 2021

61 Department of Health and Social Care, Policy paper: UK pandemic preparedness, [Annex B: Exercise Cygnus Report](#), Updated 5 November 2020

62 Government Office for Science, [Introduction to Systems Thinking for Civil Servants: Driving Improved Outcomes in Complex Situations](#), 24 May 2022

63 [Q33](#)

64 Government Office for Science, [Guidance: Systems thinking for civil servants](#), 24 May 2022

“toolkit” and a series of case studies.<sup>65</sup> The Government has also taken positive steps to address CNI resilience from a systems perspective, via development of a ‘CNI Knowledge Base’, which launched internally over the summer. The Government initially described this tool to us in written evidence:

“The CNI Knowledge Base is set to be the ‘Single Source of Truth’ for UK CNI, enabling government analysts to visualise CNI assets and systems. It allows risk owners to view UK CNI on a map or as a network graph, with interdependencies mapped across it. The tool and data are held in a secure environment, accessed only by appropriately cleared government officials”.<sup>66</sup>

31. The Cabinet Office told us that the Civil Contingencies Secretariat (then the Cabinet Office’s emergency planning and response team) had “developed a shared methodology to help the Lead Government Departments (LGDs) of the 13 Critical National Infrastructure sectors to identify, assess and understand the interdependencies between sectors”. This methodology “provides a standardised approach to collect the necessary information from all the sectors to support our understanding and monitoring of interdependencies across the UK’s infrastructure”, and will generate data and information for the Knowledge Base. Access to the Knowledge Base was at that point limited to lead departments, along with the Cabinet Office and “key agencies” such as the National Cyber Security Centre, but the Cabinet Office told us that access by CNI regulators—“as government bodies”—would be considered.<sup>67</sup>

32. In a further development on systems thinking, the Government has funded a Climate Resilience Demonstrator project (CReDo) via the ‘National Digital Twin’ programme, which was launched by the Treasury in 2018. CReDo looks specifically at the impact of flooding on energy, water and telecoms networks, combining datasets from Anglian Water, BT and UK Power Networks into one “system model”, to develop a “cross-sector picture of impact of extreme weather events on the infrastructure system”.<sup>68</sup> CReDo has described this as a “small but important first step”, compared to the potential for “connected digital twins” to “help us adapt to and mitigate the climate emergency”.<sup>69</sup>

**33. The UK’s critical national infrastructure (CNI) is fundamental to the smooth running of the economy and of society. It is becoming increasingly interconnected, and all CNI sectors are heavily reliant on a stable energy supply. The Covid-19 pandemic demonstrated how rapidly the impact of a hazard can spread—or cascade—from one part of society to another. The same is true of the effects of climate change, as extreme weather events in the past year have shown. Yet we have found very little join-up between CNI sectors, with no formal mechanism for collaboration or information-sharing on interdependencies. This has resulted in some worrying near misses and an apparent lack of planning and foresight.**

**34. The Government has begun to recognise the risks posed by the extensive interdependencies between CNI sectors. There is some promising work underway on the development of ‘digital twins’ to model climate-related infrastructure interdependencies, on which we would welcome further Government investment.**

65 Gov.uk blog, [New systems thinking products for Civil Servants](#), 29 June 2022

66 Cabinet Office ([NIC0015](#))

67 Cabinet Office ([NIC0046](#)), point 1

68 CReDo ([NIC0030](#))

69 Digital Twin Hub website, [CReDo News: What’s next for CReDo?](#) 15 December 2021, accessed 29 September 2022

The new CNI Knowledge Base is also a very positive development. It remains to be seen, however, how the Government will connect this vital analysis to infrastructure operators and regulators, whether operators will be held to account on their responses, and how the Knowledge Base will inform policy-making on climate adaptation. The Government also has unique powers to establish other mechanisms to improve oversight of interdependencies overall—such as through joint reporting under the Adaptation Reporting Power—but it has so far failed to use them.

*35. We recommend that the Government formalises collaboration between CNI regulators on climate adaptation, through a statutory forum chaired by a senior Government official (at Director General level), with key operators invited to meetings. This forum should publish an annual report to Parliament on key actions to address interdependencies and to enhance CNI resilience to climate change and extreme weather, utilising data and intelligence from the CNI Knowledge Base. The Government should also make use of the power granted by the Climate Change Act 2008 to require CNI operators and/or regulators to report jointly under the Adaptation Reporting Power.*

### Case study: improving the resilience of the UK's energy supply

36. Recent efforts to enhance energy resilience offer an enlightening case study on a crucial interdependency between CNI sectors. UK demand for electricity is set to increase significantly in the coming decades, triggered by the Government's own net zero goals and the associated move away from fossil fuels, the electrification of heat and transport sectors, and increasing digitisation across all sectors. National Grid forecasts that its network will need to increase capacity by 60% by 2030 and by 80% by 2035, as it transitions to a fully decarbonised grid.<sup>70</sup> Ofgem also highlighted that the UK's net-zero targets require the “electrification of huge amounts of energy demand across the country”.<sup>71</sup> This exposes the power system to enhanced vulnerabilities: electricity pylons and cables are more prone to disruption from extreme weather than gas, which relies mainly on underground pipes rather than overhead power cables. The shift to renewables also comes with increased risks: large thermal power stations have a relatively stable supply compared with intermittent renewables such as wind and solar, which are also more vulnerable to extreme weather.<sup>72</sup> The technical report for the third CCRA found that the energy sector was subject to an “adaptation shortfall” in relation to lightning, high winds and storms.<sup>73</sup>

37. Storm Arwen triggered a flurry of Government activity on energy resilience, including a review into how energy network operators responded to the incident, and into the resilience of electricity networks. The resulting report by the Energy Emergencies Executive Committee (E3C) recommended that:<sup>74</sup>

- There should be a review of design standards and guidance for electricity networks—such as overhead line designs—taking into account the higher dependence on electricity for the resilience of the network;

70 [Q53](#) (David Wright)

71 [Q43](#) (Dr Charlotte Ramsay)

72 Mr Colin Henry Bayfield (Retired at Industry Professional) ([NIC0001](#))

73 UK Energy Research Centre ([NIC0010](#))

74 Department for Business, Energy and Industrial Strategy, [Energy Emergencies Executive Committee Storm Arwen Review, Final Report](#), June 2022

- Operators should ensure that they have access to “high-quality weather forecasting”, and a “corresponding understanding of the implications”;
- The Department for Business, Energy and Industrial Strategy (BEIS) should audit storm reporting (the information submitted from energy companies to BEIS during power disruption) to ensure that the information is useful and can be provided in “a timely, accurate and consistent fashion to support Government decision making and prioritisation”; and
- CNI operators should share “updated planning assumptions” for electricity disruption with Ofgem and relevant Government departments, to enable them to update their own planning assumptions.

The BEIS-hosted EC3 will be responsible for the implementation of these actions, in collaboration with other partners “as appropriate”.

38. Greg Hands MP, then Energy Minister at BEIS, also told us that the new Energy Security Strategy and accompanying legislation—launched as part of wider efforts to improve the resilience of UK energy supplies in the wake of Russia’s second invasion of Ukraine—would “make the electricity and the energy system more resilient” (see Box 4 on the Energy Bill). He gave no compelling reasons why it would do so, although an accompanying BEIS official, Mark Prouse,<sup>75</sup> informed us that resilience was captured in the legislative framework for the Future System Operator (rebranded as the Independent System Operator and Planner—ISOP—on the face of the Bill).<sup>76</sup> Its functions include “carrying out strategic planning and forecasting” in relation to electricity and gas transmission.

39. The Bill may be scrapped following the appointment of Jacob Rees-Mogg as Business Secretary, however. Media reports in September suggested that the Energy Bill could be “paused or even binned” to reflect the Government’s new priorities, with certain reforms incorporated into a new “Growth Bill”.<sup>77</sup> A subsequent Growth Plan, published in September, included a chapter on “Tackling energy prices”, which made no reference to the Energy Bill or the ISOP. Meanwhile, anxieties around energy resilience have become even more acute: press reports suggest that there could be energy shortages this winter, and the Prime Minister recently called on European leaders to keep energy interconnectors open over the coming months, amidst fears that Norway could close off its interconnectors with the UK and the EU.<sup>78</sup>

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75 Deputy Director of Energy Resilience and Emergency Response at BEIS

76 [Q94](#)

77 *Financial Times*, [UK energy security bill paused to prioritise support for businesses](#), 15 September 2022

78 *The Times*, [Britain pleads for European help to avoid blackouts](#), 6 October 2022

**Box 4: The Energy Bill**

On 6 July, the Government introduced the “Energy Security Bill” to Parliament (later renamed the Energy Bill). Through the Bill’s provisions, the Government aims to attract £100 billion in private investment by 2030, prevent disruption to fuel supply, and boost the UK’s independence in relation to energy supply and security. The Bill would establish a new Independent System Operator Planner (ISOP) to coordinate and plan the country’s energy system in a “whole-system” manner across electricity, gas and emerging markets such as hydrogen, to minimise costs for consumers in the long run. It aims to maintain the resilience of UK energy systems, but does not impose any specific resilience or climate adaptation requirements on operators.

40. Announcements in September pointed to a further opportunity to enhance the resilience of the UK’s energy supply. Alongside the energy price cap subsidy, the Prime Minister committed to doing more to secure the UK’s energy supply, including through a “review of energy regulation to fix the underlying problems”. She did not specify which problems the review will seek to fix, but said that the Government wanted “a new approach that will address supply and affordability for the long term”.<sup>79</sup>

**41. The transition to net zero is vital, but it will result in the UK becoming increasingly reliant on electricity and renewable energy sources, which are more vulnerable to extreme weather than gas and other fossil fuels. Meanwhile, all other forms of CNI are heavily reliant on their energy supply, meaning that power outages have the potential to cause widespread economic and societal damage. Climate adaptation must be central to the Government’s efforts to transition to low-carbon energy sources, and to enhancing the resilience of the UK’s energy supply to global shocks.**

42. It is welcome that the Government undertook extensive work on energy resilience in the wake of Storm Arwen, but this was a reactive response to a national crisis resulting in widespread power outages lasting over a week, and necessitating military deployment. Ministers should have anticipated and been better prepared for such an event, through proactive adaptation efforts and proper crisis planning. This is demonstrative of wider shortfalls in Government risk management—as we outlined in our previous reports during this Parliament, on Biosecurity and the UK’s national security machinery. We will return to this topic in Chapter 4.

43. **The Energy Bill is a vital opportunity to improve the resilience of the UK’s energy supply, so we are concerned by reports that the legislation may be dropped—even as reports suggest that the UK could face energy shortages this winter. If the Bill is passed, the Independent System Operator and Planner (ISOP) would be tasked with carrying out strategic planning and forecasting in relation to electricity and gas transmission. *We would welcome the Government’s assurances that the ISOP’s mandate will include planning for the impact of the changing climate on the UK’s energy supply. The Government’s recently-announced review of energy regulation must also consider the extent to which the current regulatory regime allows for sufficient investment in resilience and adaptation, in line with the recommendations outlined in the final chapter of this report.***

## A shared risk picture: climate services for CNI operators and regulators

44. The Storm Arwen review noted that the event had highlighted the “critical importance of accurate, timely and relevant weather forecasts”, in combination with a “strong understanding” of their specific implications for distribution network operators (DNOs)—the companies that own and operate power lines and other forms of infrastructure. In its written evidence, the Met Office noted that “the best information is not always used” to inform climate plans for CNI, and called for a “national framework for climate services”.<sup>80</sup> This could ensure that climate services are quality assured, and that different departments, sectors and operators are working to the same assumptions.

45. Establishing a central source of data on longer-term climate risks would align with ongoing Government actions on emergency planning and response, for which it has established the National Situation Centre in the Cabinet Office. ‘Sit Cen’ brings “timely data analysis and insights from across and beyond Government to support situational awareness on crisis and national security issues”;<sup>81</sup> it is based in the Cabinet Office and supports decision-making by the COBR emergency committee. According to a BBC report last year, when not in crisis mode, “the team work on a list of well over 100 possible risks listed on a UK National Security Risk Register and try to understand what data feeds they would need if each one unfolded”. This includes data from the Met Office.<sup>82</sup>

46. **We welcome the development of the Cabinet Office’s ‘National Situation Centre’ (SitCen), which gathers and generates real-time data to inform the Government’s crisis and emergency response work—including on weather patterns. We recommend, however, that the Government explores the potential for SitCen to generate longer-term climate data and analysis for CNI operators, to inform their climate adaptation planning efforts. This should be drawn from a wide range of sources, in light of the significant uncertainties inherent in longer-term climate modelling. In the context of an open market for climate services, in which vital infrastructure operators could be relying on suboptimal weather and climate reports, this could ensure that operators and regulators are working to the same, quality-assured assumptions. It could also enhance their ability to collaborate on addressing cascading risks and interdependencies.**

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80 Met Office ([NIC0013](#))

81 National Situation Centre [jobs website](#), accessed 29 September 2022

82 BBC News, [Inside the government’s secret data room](#), 15 December

### 3 Regulating CNI: resilience standards and stress testing

47. The 13 CNI sectors represent a highly diverse field of operators, with varying levels of Government involvement in their work. There is no overarching UK regulator for CNI, with different sectors covered by a multitude of different regulators; in turn, those regulators are overseen by multiple ‘Lead Government Departments’. As noted in the last chapter, there is little formal join-up between different CNI regulators, and resilience standards and obligations vary significantly between sectors, both in general and in relation to climate adaptation. This chapter considers the state of the current regulatory landscape affecting CNI, including resilience standards, adaptation requirements and stress testing.

#### Resilience and climate adaptation requirements in different CNI sectors

48. Table 1 is replicated—with its permission—from a 2020 report by the National Infrastructure Commission (NIC),<sup>83</sup> outlining the resilience standards applied by regulators in six CNI sectors. Most sectors are subject to economic regulation (excluding most ports and airports), meaning that there are rules to ensure that lack of competition does not result in excessive prices or poor service quality,<sup>84</sup> but other forms of regulation vary significantly. Since the NIC’s report was published, Network Rail has committed to agreeing a minimum level of service in extreme weather.<sup>85</sup>

Sector	Expectation	Description
Energy and water	Restoration of supply - guaranteed standard (consumers)	The guaranteed standards for energy and water both set out how quickly members of the public should expect their service to be restored. Any failure by operators to meet these standards means consumers are eligible for compensation. <b>Consumers are clear about how long disruptions may last and the means of redress if disruptions go beyond this.</b>
Energy	Electricity system frequency - guaranteed standard (system)	The Security and Quality of Supply Standard sets out the system frequency that the electricity system operator is expected to maintain and how quickly frequency should be restored to the expected range if it falls outside of this. <b>The operator is clear about the expected normal operation of the system, how quickly frequency should be restored, and what circumstances require further action.</b>

83 The NIC is an Executive Agency of HM Treasury; it carries out in-depth studies into the UK’s major infrastructure needs and makes recommendations to the Government

84 UK Parliament POST Note 621, [Infrastructure and climate change](#), 27 March 2020

85 Network Rail, [Environmental Sustainability Strategy 2020–2050](#), September 2020

Sector	Expectation	Description
Water	Drinking water quality	Drinking water quality standards for England are set out in legislation. Standards are <b>clear, specific and strongly enforced</b> through fines as a result of prosecutions.
Rail	Expected service during bad weather	Network Rail has clear definitions of both 'adverse' and 'extreme' weather. While both are linked to the potential for disruption, <b>the magnitude of disruption is not defined</b> . Network Rail has previously noted that <b>public expectations of the level of service during 'adverse' weather may not be met</b> .
Road	Reliability of road journeys	Highways England uses a journey reliability indicator as part of its performance measures. However, there is no specified target. Without a target, <b>measuring progress is not transparent and it is difficult to evaluate whether journeys are as reliable as expected</b> .
Digital	Service availability	Ofcom's general conditions require communications providers to maintain uninterrupted access to emergency organisations "to the greatest extent possible". This is <b>clear and strongly enforced</b> , with significant fines for failures. <b>This is a more strict obligation</b> than the "appropriate steps" required to be taken to ensure general network availability.

49. In relation to climate adaptation specifically, we also found that operators face a wide range of requirements. For example:

- **Energy:** For Ofgem's next price control period, which commences in April 2023, the regulator required the distribution network operators (DNOs) to submit a climate resilience strategy, and "to establish related working groups to support the sharing of best practice".<sup>86</sup> Having received the DNOs' submissions in December, Ofgem planned to "consider the case for investments in infrastructure" in its subsequent "determinations" on price controls, later in 2022.<sup>87</sup> Further work on energy resilience is also underway as a result of Storm Arwen, as outlined in the previous chapter.
- **Nuclear:** The Office for Nuclear Regulation (ONR) requires nuclear facilities to "withstand severe weather conditions, including the reasonably foreseeable effects of climate change over the lifetime of the facility", and to "withstand flooding hazards, which include combined storm events which could be affected

86 Ofgem ([NIC0016](#))

87 *Ibid*

by climate change”. Standards are enforced via regular inspections.<sup>88</sup> There is no oversight of the continuity of supply of nuclear energy, however, and safety procedures during hot weather could result in reductions in supply.<sup>89</sup>

- **Water:** Ofwat requires water companies to identify, plan for and mitigate the effects of climate change on their service provision, through its price review framework.<sup>90</sup> The sector is also subject to a statutory resilience duty, through (subsequent amendments to) the 1991 Water Industry Act.<sup>91</sup>
- **Communications:** Ofcom’s network access duties give it some oversight of resilience in the broadest sense, but it has no legislative duty to ensure that operators undertake any climate adaptation activities.<sup>92</sup>
- **Transport:** The Office of Rail and Road (ORR) requires Network Rail to produce “Weather Resilience and Climate Change Adaptation plans”, which set out priorities and high-level approaches for eight geographical routes.<sup>93</sup> Its regulation of roads is much more hands-off, however: it does not require National Highways to plan for the effects of climate change.<sup>94</sup>

#### Box 5: Results of our survey of infrastructure operators

We held a survey of infrastructure operators in February to April 2022, to support this inquiry. We asked respondents about their experience of and preparation for extreme weather events and climate change, as well as their views on Government support for CNI resilience. 22 organisations shared their views with us; the largest group were from the energy sector (8 participants), followed by transport (5) and water (4). We found that:

- 13 out of 22 respondents (59%) had experienced a “major outage” and 10 had experienced a “near miss” linked to extreme weather (or other climate change effects) in the last year.
- Nine out of 22 respondents (41%) reported that their management boards (or equivalent) reviewed their preparations for extreme weather and other forms of climate change “multiple times per year”; for six (27%), it was around once per year. For three respondents, it was on an ad hoc basis.
- Only a third of respondents (seven in total) plan more than a decade in advance for the effects of climate change; five (23%) plan for six to ten years ahead.
- Only four respondents (18%) rated as “good” the UK Government’s support for climate adaptation and CNI resilience and six (27%) rated it as satisfactory. Four respondents said that it was poor.

## The case for clear, cross-sector resilience standards

50. Through its Net Zero Strategy, the Government has set clear, mandatory targets for climate mitigation, committing to fully decarbonising the power system by 2035 and reducing greenhouse gas emissions to net zero by 2050. The Government has been

88 Office for Nuclear Regulation ([NIC0021](#)), point 1.3

89 Office for Nuclear Regulation ([NIC0034](#))

90 Ofwat ([NIC0033](#))

91 Water Industry Act 1993, [Section 37AA](#)

92 [Communications Act 2003](#)

93 Network Rail website, [Climate change adaptation](#), accessed 29 September 2022

94 Office of Rail and Road ([NIC0017](#))

criticised by the CCC for shortfalls in its implementation of those net zero plans,<sup>95</sup> and it has recently commissioned a review of the Strategy by Chris Skidmore MP.<sup>96</sup> Nevertheless, there is little doubt that the Strategy's ambitious aims have resulted in cross-Government action, driven by the knowledge across Whitehall that this was a priority for the then Prime Minister. There are no such targets or standards for climate adaptation, which may have hindered progress in this vital policy area.

51. Rather than setting targets or empowering most regulators, the Government has largely left adaptation efforts in the hands of operators, inviting them to report (voluntarily) on their progress through the Adaptation Reporting Power. The Adaptation Committee reviewed the 88 adaptation reports received by the Government last year; it acknowledged that many sectors are producing "high quality adaptation reports", but the Committee found that "significant areas for further improvement remain". Some organisations, for example, are not providing timescales for completing their adaptation actions,<sup>97</sup> and the Committee also found that there was a lack of preparation for the impact on operators of shutdowns in other sectors. According to the Chair of the Adaptation Committee, Baroness Brown, "to varying degrees the organisations we have assessed are not prepared for cascading infrastructure failures."<sup>98</sup>

52. Recent events have illustrated the cost of inadequate resilience standards for major infrastructure operators, as well as the severe dangers that can be generated by changing weather patterns. In August 2020, three people died near Stonehaven in Scotland when a passenger train derailed after hitting debris on the track, washed from a drainage trench by heavy rainfall. The Rail Accident Investigation Branch's final report indicated that Network Rail's risk management processes had fallen short, including in relation to the accuracy of weather forecasting, the reliability of risk assessment, the deployment of sufficient resource, and the ability to monitor rainfall events in real-time.<sup>99</sup> Steve Fletcher, Deputy Director for Engineering and Asset Management at the ORR, told us that Network Rail had come a long way on climate adaptation in the last ten years, but that there was more to be done to improve its approach.<sup>100</sup>

53. It is perhaps because of these acute dangers that the National Infrastructure Commission (NIC) concluded, in its 2020 report on infrastructure resilience, that resilience standards "cannot be left entirely to the market". It added that resilience is "not properly valued in the market": often, "consumers cannot choose different levels of resilience, and infrastructure failures do not just affect consumers". Its report also noted that "infrastructure operators do not always have the right incentives for resilience", and that there can be a "failure to acknowledge resilience challenges, which may be due to optimism, denial, or a lack of challenge or scrutiny of plans and assumptions".<sup>101</sup>

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95 Climate Change Committee news item, [Current programmes will not deliver Net Zero](#), 29 June 2022

96 BEIS press release, [Chris Skidmore launches net zero review](#), 26 September 2022

97 Climate Change Committee, [Understanding climate risks to UK infrastructure: Evaluation of the third round of the Adaptation Reporting Power](#), 11 July 2022

98 Climate Change Committee, [Key organisations failing to tackle threat of cascading climate risks](#), 11 July 2022

99 Rail Accident Investigation Branch, [Rail Accident Report: Derailment of a passenger train at Carmont, Aberdeenshire](#), 12 August 2020, published March 2022

100 [Q44](#)

101 National Infrastructure Commission, [Anticipate, React, Recover: Resilient infrastructure systems](#), May 2020

54. Addressing these issues, the NIC concluded, “requires a framework for resilience that faces uncomfortable truths, values resilience properly, tests for vulnerabilities and drives adaptation before it is too late”. To that end, the NIC called for:

- The Government to publish a “full set of resilience standards” every five years, following regulators’ advice, along with “an assessment of any changes needed to deliver them”;
- The Government to ensure that Ofwat, Ofgem and Ofcom have resilience duties, and “consider whether to extend this to road and rail”; and
- By 2023, regulators to introduce obligations on infrastructure operators, requiring them to meet the Government’s resilience standards and to develop and maintain long term resilience strategies (where there is no current requirement).<sup>102</sup>

55. The NIC is not alone in its calls for reform: a number of other stakeholders have also called for much clearer standards and frameworks. For example:

- The Climate Change Committee called last year for the Government to set out “clear quantified targets” on adaptation, “supported by policies and regulation”;<sup>103</sup>
- The Lords Committee on Risk Assessment and Risk Planning (RARP Committee) recommended last year that a statutory duty be placed on all CNI operators to produce and publish an audited business continuity plan, covering risk management and resilience more broadly;<sup>104</sup>
- David Wright, Chief Engineer at the National Grid Group, told us that cross-sector resilience standards were needed, to ensure a “joined-up picture” across all aspects of UK CNI;<sup>105</sup>
- Network Rail advocated for the introduction of standards and implementation frameworks to define the level of resilience required for different asset types;<sup>106</sup> and
- Professor Jim Hall noted that the statutory resilience duty on water companies had led to much more focus on long term resilience.<sup>107</sup>

56. The Government accepted the NIC’s recommendations in principle, but said that “details” of its plans would be finalised “after the outcome” of the National Resilience Strategy. This would include “considerations of which stakeholders would be in scope, content, timeframes, the legal status of such standards, how they would align with existing standards and appropriate measures to ensure compliance”. The Resilience Strategy was due to be published by Spring 2022, but has been delayed until later this year. The Government also rejected the Lords RARP Committee’s calls for operators to be required to produce audited business continuity plans, stating that lead Government departments for the “critical sectors” already “work closely with owners and operators to ensure they

102 *Ibid*

103 Climate Change Committee, [Progress in adapting to climate change: 2021 Report to Parliament](#), June 2021

104 House of Lords Risk Assessment and Risk Planning Committee, [Preparing for Extreme Risks: Building a Resilient Society \(HL110\)](#), 3 December 2021

105 [Q59 \(David Wright\)](#)

106 Network Rail ([NIC0012](#)), point 5

107 [Q29](#)

are planning for relevant risks and encourage the production of business continuity plans”. The Government “does not consider it necessary to place a further statutory duty” on CNI operators “at this point.”<sup>108</sup>

57. We raised the issue of resilience standards with Roger Hargreaves, Head of the Civil Contingencies Secretariat at the Cabinet Office, who had drawn on the Australian regulatory model as a comparator. Australia has a ‘horizontal’ regulatory framework for CNI, with several sectors overseen by the Australian Competition and Consumer Commission. Mr Hargreaves acknowledged that there was scope for regulatory reform in the UK, but argued that “it would not make sense” to follow the Australian model, because existing regulations are “quite complex”.<sup>109</sup> He added:

“We would not want, for example, to unpick the way energy markets work to layer across a new horizontal regulation for resilience, but we can lift the standards. Some of those sectors have very high standards for resilience and others less so. Where it is less so, we need to lift it up, and that is where we have settled.”<sup>110</sup>

## Stress testing

58. The 2008–09 global financial crisis had a fundamental impact on risk management, particularly within financial institutions. ‘Stress testing’ is a common element of managing risk for such organisations, including in the UK, enabling them to identify weak points in their operations and identify changes to mitigate the risk of harm.<sup>111</sup> In its 2020 report on infrastructure resilience, the NIC pointed out that the infrequency of extreme events—such as severe weather—means that there might be vulnerabilities that only come to light when problems occur; in August 2019, for example, train passengers were stranded for hours in the South-East of England after a lightning strike disrupted power supplies.<sup>112</sup>

59. The NIC consequently called on regulators to introduce new obligations on infrastructure operators to undertake stress tests, which it described as “thorough, desk based testing used to determine the stability of the system and determine its ‘breaking point’”. Stress tests can also help infrastructure operators to test decision-making processes more broadly, preparing them for additional disruptions beyond those set out in the tests.<sup>113</sup> The NIC argued that regulators would be well placed to take on responsibilities for overseeing stress tests, and called on them to set out initial plans for such tests (including scenarios and scope) by 2022, ensuring that the first round of stress tests have been completed by operators by 2024.

60. Witnesses to our inquiry were supportive of the NIC’s proposal: Dr Swenja Surminski, then Head of Adaptation Research at LSE’s Grantham Research Institute, told us that stress testing could improve CNI sectors’ capacity to prepare for multiple climate events occurring simultaneously,<sup>114</sup> and Professor Hall argued that it was “absolutely

108 Cabinet Office, [Government response to Preparing for Extreme Risks: Building a Resilient Society](#) (CP641), 17 March 2022

109 [Q85](#)

110 [Q85](#)

111 The Conversation, [What is a climate stress test? A sustainable finance expert explains](#), 23 January 2022

112 National Infrastructure Commission, [Anticipate, React, Recover: Resilient infrastructure systems](#), May 2020

113 *Ibid*

114 Q6 (Dr Swenja Surminski)

fundamental” that “a systematic and agreed set of protocols” for stress tests was established. He also recommended “a very systematic approach to following up and checking whether the lessons learned have been implemented”.<sup>115</sup> Witnesses praised the financial sector’s approach to stress testing for the effects of climate change, with Dr Surminksi noting that there are “interesting lessons to be learned”, including from the Bank of England’s detailed stress-testing framework on climate-related risks.<sup>116</sup>

61. In its response to the NIC’s report, the Government agreed with the need to “establish expectations for stress testing against resilience standards”, but noted that the National Resilience Strategy would influence the “nature and shape of any new requirements for exercises and testing”.<sup>117</sup>

**62. The regulatory landscape of CNI is extremely fragmented, with a variety of different approaches to climate adaptation and resilience. There are worryingly low levels of activity in some sectors, and some clear regulatory gaps, such as the fact that there is no oversight of the continuity of nuclear energy supply. We acknowledge that different sectors have different adaptation needs; nevertheless, this scattergun application of regulatory responsibilities is no longer tenable.**

**63. In 2020, the National Infrastructure Commission (NIC) made strong, evidence-based recommendations to improve CNI regulation in relation to resilience, which would have been highly applicable to CNI operators’ preparations for climate change. Unfortunately, the Government has delayed implementation of these reforms until its National Resilience Strategy (NRS) is published. The NRS itself has been delayed several times, despite being a key commitment of the Integrated Review over 18 months ago. The costs of failure are extremely high, as demonstrated by the fatal rail accident near Stonehaven in 2020; these ongoing delays to implementation are therefore extremely unfortunate.**

**64. We note the Government’s concerns about the complexity of the regulatory landscape and the difficulty of imposing a more uniform regulatory regime. We agree with the NIC, however, that resilience cannot be left entirely to the market. Indeed, our survey found that only a third of responding organisations planned more than a decade in advance for the effects of climate change. *We suggest that the Government undertakes more detailed work on international comparators in relation to regulatory regimes. In addition, in line with the NIC’s 2020 report on resilience, we recommend that:***

- ***The Government should publish a full set of resilience standards every five years, for the sectors under the NIC’s purview at a minimum (energy, water, digital, road and rail services); it should also examine how these could apply to other CNI sectors.***
- ***CNI regulators should require their operators to develop long-term resilience strategies;***

115 Q29 (Jim Hall)

116 Q19 (Dr Swenja Surminksi)

117 Cabinet Office, [Government Response to the National Infrastructure Commission report ‘Anticipate, React, Recover: Resilient Infrastructure Systems’](#), 15 September 2021

- *Recognising that CNI should be tested regularly against a wide range of stresses, including interdependencies, regulators should oversee a programme of stress testing against a range of risks that might affect critical services; and*
- *These resilience standards and stress tests should specifically address the effects of climate change in the short, medium and long term, to ensure that CNI operators are planning for a range of potential scenarios.*

## 4 Ministerial oversight and cross-Government action

65. Our final evidence session for this inquiry took place in the midst of an unprecedented heatwave in the UK, with temperatures hitting 40.3°C.<sup>118</sup> We expected our panel of witnesses to include a Cabinet Office Minister: this is almost always the case, given the cross-departmental nature of our remit and the Cabinet Office's oversight of national security policy. On this occasion, however, the Cabinet Office Minister with responsibility for CNI resilience (and now Attorney General), Michael Ellis MP, ultimately refused to appear before us. A timeline of key events is set out in Box 6, illustrating that Mr Ellis demonstrated a surprising shift in rhetoric between his written evidence in April, when he asserted his commitment to "improving the chronic risk posed by Climate Change", and his letter of 27 June, in which he suggested that he was not a Minister with "responsibility for the policies in question". The evidence that we outline in this chapter suggests that his behaviour reflected a serious lack of accountability for CNI resilience to climate change at the very heart of Government.

66. This chapter considers first the need for a more joined-up Government approach to this issue, followed by an overview of ministerial responsibilities and cabinet committees. We then consider the key policy and risk management frameworks for CNI and climate adaptation, and make recommendations for reform.

### Box 6: Ministerial evidence session - timeline of events

- **1 February:** The Minister for the Cabinet Office, Michael Ellis, submitted written evidence to our inquiry. He noted that he was writing in his "capacity as Minister responsible for resilience and security", in which he was "charged to ensure that the security and resilience of Critical National Infrastructure is a top priority for the Government".
- **28 March:** Committee staff sought to secure the Minister's attendance for the final evidence session, originally scheduled for 4 July. Given the diffuse responsibility for this issue across Government, oral evidence was requested from more than one Minister. It was initially suggested that Alok Sharma might be the appropriate individual to appear alongside a Cabinet Office Minister, given that he was then chairing the cross-Government committee with responsibility for both net zero and climate adaptation.
- **4 April:** Mr Ellis stated in his supplementary written evidence that he was "the Lead Government Minister for resilience and security, and accordingly for CNI resilience". He also asserted: "In my capacity as Minister responsible for resilience and security, I am committed to tackling and improving the chronic risk posed by Climate Change".
- **28 April:** Cabinet Office officials queried whether the Committee would consider inviting Ministers from BEIS and the Department for Environment, Food and Rural Affairs (Defra) to give evidence alongside the Minister for the Cabinet Office.
- **16 May:** Cabinet Office officials advised that Alok Sharma did not have responsibility for national infrastructure or climate adaptation, and that the request would be better directed at BEIS and Defra Ministers.

118 Met Office press release, [Record high temperatures verified](#), 28 July 2022

- **9 June:** Having been told by officials that Greg Hands, then the Energy Minister at BEIS, was unable to attend on the specified date and had offered to send a BEIS official instead, Committee staff asserted that the Committee expected a BEIS Minister to attend.
- **24 June:** Government officials confirmed—with ten days’ notice—that Greg Hands and the Defra Minister with responsibility for climate adaptation, then Jo Churchill, were willing to give evidence, but that they were unavailable on 4 July. Mr Ellis refused to give evidence alone; when we offered to reschedule the session to allow all three Ministers to appear, it was made clear to us that Mr Ellis would refuse to give evidence to us on this topic *at any time*.
- **27 June:** In a letter to justify his refusal to appear before us, Mr Ellis suggested that he was “the convening Minister only, rather than a minister with responsibility for the policies in question”, and that it would “not be appropriate or reasonable for me to speak to the work of other government departments”, nor to “answer questions specifically about climate adaptation”.<sup>119</sup> Replying on the same day, the JCNSS Chair noted that we had “sufficient questions about your responsibilities alone, yet we are not being offered the opportunity to discuss these with you”.
- **18 July:** In the midst of a major heatwave affecting UK CNI, we took oral evidence from Greg Hands, the then Energy Minister; Steve Double, then the Minister with responsibility for climate adaptation at Defra; Mark Prouse, Deputy Director for Energy Resilience and Emergency Response at BEIS; Robert Mason, Deputy Director for Climate at Defra; and Roger Hargreaves, Head of the Civil Contingency Secretariat at the Cabinet Office.

**67. Having received two pieces of written evidence from the Minister for the Cabinet Office, then Michael Ellis, we were astounded when he subsequently refused to give evidence to us on a topic of such importance to the UK’s national security and prosperity. We note that the then Defra Minister, Steve Double, stepped in at very short notice, having been in post for only ten days. We are also very grateful to Roger Hargreaves for providing helpful and informative oral evidence on the Cabinet Office’s behalf. Their actions only serve to underscore what a dereliction of duty it was for Mr Ellis to refuse to appear before us—not only in relation to his willingness to be accountable to Parliament, but also in what it suggests about his commitment to deliver for the public that he serves. We can only hope that his successor will take more interest in this vital topic.**

### **Lack of ownership and accountability**

68. A number of witnesses stressed the importance of a more joined-up Government approach to climate adaptation and CNI resilience; the infrastructure interdependencies outlined in Chapter 2 make this all the more important, given the high risk of unanticipated, ‘cascading’ failures. Unfortunately, the evidence that we considered suggested that such join-up is currently poor. For example:

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<sup>119</sup> [Correspondence with the Chancellor of the Duchy of Lancaster and the Minister for the Cabinet Office relating to oral evidence on the impact of climate change on infrastructure, dated 29 June and 27 June 2022, published 18 July 2022](#)

- Professor Richard Dawson told us that “there is fragmentation in tackling a lot of these risks across government”, and called for more “joined-up oversight, because a lot of the risks are in danger of falling through some of the gaps”, particularly in relation to interdependencies.<sup>120</sup>
- The Environment Agency told us that “Infrastructure interdependencies and the potential for cascading climate risks are poorly understood”, and that “There needs to be greater clarity of the roles and responsibilities of state and non state players”.<sup>121</sup> It also noted that there is “good work” on climate adaptation in individual departments, but it is “generally ad hoc”.
- The Adaptation Committee’s latest Independent Assessment, which was accepted by the Government, found that “Siloed thinking remains a problem for addressing climate change risks or opportunities that interact or are subject to cascading impacts, or where adaptation responsibility falls across more than one Government department.”<sup>122</sup>
- The CCC noted recently that climate adaptation was missing from key policy documents, such as the Levelling Up White Paper, and argued that it needed to be embedded and integrated properly “across the policy landscape”.<sup>123</sup>
- Sir John Armitt argued that the departmental structure incentivises against coordination, noting that “You get more brownie points for succeeding as a divisional boss than you do for co-operating across your colleagues”, and said that the regular change in Ministers exacerbates this issue.<sup>124</sup>

69. The evidence that we outline below suggests that these concerns were not misplaced. Perhaps the most damning evidence in support of our assessment, however, is the Government’s abject failure to deliver on the CCC’s adaptation recommendations. In 2021, it set 82 recommendations for actions to progress adaptation prior to the publication of the next National Adaptation Plan; of those, only five crosscutting recommendations had been achieved by July 2022, and none of the recommendations specifically focussed on adaptation had been implemented in full.<sup>125</sup> Shockingly, the CCC found that the UK has moved backwards in the last five years, with a widened gap between future levels of risk and planned adaptation.<sup>126</sup>

## Ministerial and departmental ownership

70. At the first oral evidence session for this inquiry, we asked our expert witnesses to identify the Minister responsible for CNI resilience to climate change. None of them were able to give a clear answer. Dr Will Lang from the Met Office said: “I do not believe there

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120 [Q8](#) (Professor Richard Dawson)

121 [Environment Agency \(NIC0014\)](#)

122 [Climate Change Committee, \*Independent Assessment of UK Climate Risk: Advice to Government for the UK’s third Climate Change Risk Assessment \(CCRA3\)\*, June 2021](#)

123 [Climate Change Committee, \*Progress in reducing emissions, 2022 Report to Parliament\*, p.28, June 2022](#)

124 [Q11](#)

125 [Climate Change Committee, \*Progress in reducing emissions, 2022 Report to Parliament\*, p.506, June 2022](#)

126 [Climate Change Committee, \*Progress in reducing emissions, 2022 Report to Parliament\*, June 2022](#)

is a single Minister with the specific responsibility for CNI resilience to climate change”.<sup>127</sup> The Government also seemed to struggle to identify the relevant Ministers to give evidence to us, as outlined above.

71. This confusion may stem from the ill-defined allocation of responsibilities for CNI resilience and climate adaptation across Government. Although Defra is the lead Government department for climate adaptation, the Cabinet Office is the overall departmental lead on the resilience of CNI, and it designates a lead Government department (LGD) for each of the 13 CNI sectors. With Cabinet Office support, LGDs are responsible for “resourcing and overseeing levels of preparedness to the potential consequences of each risk” in the National Security Risk Assessment.<sup>128</sup> Relevant departments also produce National Policy Statements for England and relevant reserved matters, to guide significant infrastructure project decisions (e.g. on ports and waste water), including adaptation requirements.<sup>129</sup>

72. Michael Ellis told us in written evidence that he was the lead Government Minister for resilience and security, and “accordingly for CNI resilience”, but that each sector has a minister who “remains accountable for the security and resilience of their respective sector”.<sup>130</sup> At the final evidence session, we pressed Government witnesses on which department and Minister held responsibility for the interdependencies between CNI sectors. Robert Mason from Defra told us that his team was responsible for “picking out the interdependencies” between sectors in relation to climate adaptation, and in “getting individual risk owners for all those risks and for departments to take responsibility”. When asked which Minister would brief the Prime Minister on CNI resilience to climate change, Roger Hargreaves said that it would “probably” be a double act between the Minister for the Cabinet Office and a Minister from Defra.<sup>131</sup> This might be the first time they had performed such an act, however: Michael Ellis told us in April that he’d had “no formal engagement” with Defra’s Minister for Climate Adaptation on this issue.<sup>132</sup>

73. Even the Government has recognised that there is insufficient clarity over departmental ownership of climate adaptation, with the CCRA noting that there are “many barriers to effective adaptation that we must overcome”, including “lack of clarity on ownership of risks and responses”. It also recognises that more leadership is required: the CCRA “accepts that to date our actions have not been sufficient in meeting the increasing risks from climate change”, and states that the Government has been “working at pace to mainstream adaptation to climate change in policy planning across government”.<sup>133</sup> Unfortunately, we saw little evidence that this was yet the case.

## Cabinet Committees

74. Cabinet Committees take collective decisions that are binding across Government; they are an important vehicle for progressing cross-departmental policy programmes.

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127 [Q16](#)

128 JCNSS, [Biosecurity and national security: Government Response to the Committee’s First Report of Session 2019–21](#), Recommendation 3, 2 March 2021

129 National Infrastructure Planning website, [What are National Policy Statements?](#) Accessed 29 September 2022

130 Cabinet Office ([NIC0046](#)), para 20

131 [Q92](#)

132 Cabinet Office ([NIC0046](#))

133 Defra, [UK Climate Change Risk Assessment 2022](#), 17 January 2022

Unfortunately, we found scant evidence of climate adaptation work being driven forward by any of the relevant Cabinet Committees, which was reflected in its apparent lack of prioritisation by the Cabinet Office and the Government more widely.

75. There were two Cabinet Committees dedicated to climate change under the Johnson-led Government: the Climate Action Strategy group, chaired by the Prime Minister, and the Climate Action Implementation (CAI) Group, chaired by the COP26 President, Alok Sharma.<sup>134</sup> The latter group was tasked with considering matters relating to the delivery of COP26, net zero and “building the United Kingdom’s resilience to climate impacts”. Neither group was referenced in the Government’s written submission, and Alok Sharma also declined to give evidence during the oral evidence session with the Government on 18 July (as outlined in Box 6), suggesting he did not consider himself to be accountable for cross-government work on climate adaptation. Under recent changes to Cabinet Committees under the new Prime Minister, The CAI group has been retained, but the Strategy group has been disbanded. CAI’s terms of reference no longer reference adaptation, however: the group is simply tasked with “the delivery of the United Kingdom’s domestic and international climate strategy”, and there are no Cabinet Office Ministers represented on it.<sup>135</sup>

76. The Government was unable to point to any cross-government structures focused on CNI resilience to climate change, as outlined in Chapter 2 of this report. CNI resilience more broadly may have benefited *briefly* from more oversight: the Government told us last year that a new National Security Ministers (NSM) (Resilience) Sub-Committee had replaced the NSC (Threats, Hazards, Resilience and Contingencies) Committee, which was disbanded in 2019.<sup>136</sup> It also disclosed that a Resilience Directors General group was responsible for discussing how “resilience can be collaboratively improved across the UK”.<sup>137</sup> Following the recent abolition of the National Security Council and establishment of a new Foreign Policy and Security Council (FPSC), however, the National Security Adviser told us that “there are no current plans to schedule meetings of National Security Ministers”, including the Resilience sub-committee, and that “Resilience issues will be discussed at FPSC”.<sup>138</sup> FPSC’s remit also includes national security, foreign policy, defence, trade, international relations, development, and resource security.<sup>139</sup>

77. The creation of the NSM (Resilience) group arose from wider reforms to NSC structures last year, which may also have impacted on the Prime Minister’s oversight of key national security risks and hazards. Our report on the UK’s national security machinery criticised the outcomes of the National Security Adviser’s (NSA’s) review of national security systems and processes, with the Prime Minister only chairing NSC once per month and a ‘National Security Ministers’ group meeting in parallel, with a revolving Chair. We described this as a “retrograde step that suggests a more casual approach to national security”, and subsequently urged the then Prime Minister to depart from this approach, imploring him to reinvigorate the NSC “as the principal ministerial body for managing and assessing risks to the UK’s national security”.<sup>140</sup> The new FPSC will be

134 Cabinet Office, [List of Cabinet Committees and their membership](#), 23 September 2022

135 *Ibid*

136 JCNSS, The UK’s national security machinery: Government Response to the Committee’s First Report ([HC947](#)), 9 December 2021

137 [NIC0046](#) (Cabinet Office), para 6

138 [Correspondence with the National Security Adviser](#), published 20 October 2022

139 Cabinet Office, [List of Cabinet Committees and their membership](#), 23 September 2022

140 [Correspondence to the Prime Minister relating to The UK’s national security machinery](#), 17 December 2021

chaired by the Prime Minister, but it may not be an improved state of affairs: the NSA told us that FPSC would meet “at least once a month”, but with an expanded remit to consider, adding trade and Europe to the NSC’s (already wide) list of priorities.<sup>141</sup>

78. **It appears that there has been no single Minister taking responsibility for the immense challenge of adapting CNI to the effects of the changing climate, which has been falling through the cracks between Government departments. Despite chairing the Climate Action Implementation Committee, which was tasked with “building the United Kingdom’s resilience to climate impacts”, Alok Sharma felt unable to give evidence on this topic. Mr Ellis admitted to us that he was not overseeing a central programme of work, but rather played a “convening role” in relation to the Government’s written evidence. He also disclosed that he had never met the Defra Minister for Climate Adaptation to discuss CNI resilience to climate change, which may reflect the lack of any Ministerial forum to discuss this issue.**

79. **The Government has rightly focused extensive efforts on the path to net zero, but the irreversible effects of climate change are already with us, and are set to worsen significantly. This requires prioritisation at the highest levels of Government. Defra told us that its team of officials are responsible for “picking out the interdependencies” between CNI sectors in relation to climate adaptation, and referring them to other departments. Critical vulnerabilities require more than just information-sharing between civil servants, however—they require clear ownership by Ministers, and the coordination and oversight that the Cabinet Office is usually expected to provide. It is hard to imagine this approach being applied to any other national security risk.**

80. *We recommend that the Government establishes a Minister of State for CNI Resilience and a team within the Cabinet Office to focus on this issue, across a range of national security threats and hazards. To drive forward this work across departments, the Government should also re-establish a Ministerial committee on resilience, following the recent abolition of the National Security Council and its sub-committees (including the Resilience sub-committee of National Security Ministers). This group should regularly consider both climate adaptation and CNI interdependencies, reporting to the Foreign Policy and Security Council on an annual basis.*

## Key policy and risk management frameworks

81. We identified a number of relevant programmes of Government activity with relevance to our inquiry, but there were few formal connections between them. Two of the major policy frameworks—the National Adaptation Programme and the National Resilience Strategy—are currently in development, which could provide an opportunity to drive forward a more ambitious programme of activity on CNI resilience to climate change. The manner in which the Government manages major risks—through the National Security Risk Assessment (NSRA)—has also undergone review, but there has been no public output from any subsequent reforms. This section provides an overview of those three key frameworks.

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141 [Correspondence with the National Security Adviser](#), published 20 October 2022

## ***The National Adaptation Programme***

82. The Climate Change Act requires the Government to produce a National Adaptation Programme (NAP) in response to the CCRA. The NAP sets out the actions that the UK Government and other organisations<sup>142</sup> will take to adapt to the challenges of climate change in England over a five-year period. The second NAP period for England runs from 2018 to 2023, and covers actions to be taken in relation to infrastructure, as well as the natural environment, business and industry, local government, and “people and the built environment”.<sup>143</sup> It is informed by the CCRA and by the reports submitted by infrastructure operators under the Adaptation Reporting Power.

83. The last NAP took a fairly hands-off approach to CNI operators’ climate adaptation plans, noting that “private businesses [...] are responsible for their own business continuity measures”. It recognised that “more action is needed to encourage information sharing between infrastructure operators to improve overall risk management”, but it is unclear what actions were taken to address this. In its latest Progress Report, published in July 2022, the Committee on Climate Change concluded that there had been “minimal policy progress” on adaptation in the last year, and that it was “vital that the next National Adaptation Programme [...] provides a genuine step-change in the UK’s approach to climate change adaptation.”<sup>144</sup>

84. Defra is preparing the third National Adaptation Programme (NAP3), due to be published next year. Robert Mason told us that he had a team of 17 civil servants working on it, and suggested that it might be more ambitious than the last NAP:

“We have taken the evidence from the Climate Change Committee and are working through those risks, including the interdependencies between risks and, particularly in relation to infrastructure, the possible problems caused by cascading risks. The focus of this year’s work is to get a programme that is truly adaptive for this country, having accepted that we have fallen behind the risk in the past.”<sup>145</sup>

## ***National security risk management***

85. Climate-related risks in the short term are included in the National Security Risk Assessment (NSRA), a classified version of the National Risk Register (NRR), which covers security risks that may materialise in the next two years. The NSRA is intended to identify and assess those short-term security risks, generate actions, and offer evidence to enable central and local government to undertake contingency planning. The Civil Contingencies Secretariat (CCS) in the Cabinet Office has historically managed the NSRA and coordinated the Government’s response, but the CCS is being disbanded and its functions absorbed into two new teams, focusing on crisis response and resilience respectively.<sup>146</sup>

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142 These organisations include public bodies, local authorities, the owners of critical national infrastructure and their sectoral regulators.

143 Defra, [Climate change: second national adaptation programme \(2018 to 2023\)](#), 19 July 2018

144 Climate Change Committee, [Progress in reducing emissions, 2022 Report to Parliament](#), p.506, June 2022

145 [Q81](#)

146 [Correspondence with the Chancellor of the Duchy of Lancaster](#) relating to crisis resilience structures in the Cabinet Office, dated 15 August, 8 September, 27 September and 3 October 2022

86. The Government considers the two-year NSRA and the five-year CCRA to be “complementary but separate processes”.<sup>147</sup> The Cabinet Office told us that the NSRA and CCRA were linked informally, and that the CCRA was one source to inform whether a risk meets the threshold for inclusion in the NSRA.<sup>148</sup> Roger Hargreaves referred to NSRA risks as “acute events” in need of an operational response, whereas the climate change risks managed by Defra, through the CCRA and NAP, are “much longer term in nature” and require a policy response.<sup>149</sup> The NSRA nevertheless includes climate-related risks: in the 2010 and 2015 NSRAs, “a major natural hazard” that requires a national response, such as severe flooding, was identified as a Tier 1 risk.

87. This overlap between the NSRA and the CCRA adds further complexity to a risk management system that has already been extensively criticised—including by us. Our 2021 report on the UK’s national security machinery found that the centre of Government maintains a relatively hands-off approach to risk management, rather than actively holding ‘lead departments’ to account for preparedness.<sup>150</sup> Similarly, the Lords RARP Committee found that there is currently “an excess of siloed planning and a failure by departments to plan for risks for which they are not the LGD”.<sup>151</sup>

### ***The National Resilience Strategy***

88. From July to September, the Government launched a consultation on its future National Resilience Strategy—a sub-strategy of the Integrated Review—via an extensive online survey. The consultation did not set out specific policy proposals, but rather sought views on the Government’s “vision for 2030”:

“Our vision for 2030 is that we will have a strengthened ability to assess and understand the risks we face. Our suite of systems, infrastructure and capabilities (including international systems) for managing those risks should become more proactive, adaptable and responsive; and there should be fewer regional inequalities in our resilience. As a result, our local communities, businesses, and the UK as a whole, will be more cohesive, resistant to shocks and stresses, and ultimately more adaptable to future threats and challenges.”<sup>152</sup>

89. The Government’s written evidence to our inquiry stated that the National Resilience Strategy will “include consideration of the role of the private sector and CNI in building national resilience”. It will “outline our approach to working with a wide range of partners, including with the private sector and CNI operators”, and it is being developed following “extensive engagement with stakeholders, including those that deliver our CNI”. The Cabinet Office is leading on the Strategy, and Roger Hargreaves advised us that it is “intended to be framing”:

147 [NIC0046](#) (Cabinet Office), para 22

148 [NIC0046](#) (Cabinet Office), para 22

149 [Q92](#)

150 Joint Committee on the National Security Strategy, [The UK’s national security machinery](#) (HC231/HL68), 13 September 2021

151 Cabinet Office, [Government response to Preparing for Extreme Risks: Building a Resilient Society](#) (CP641), 17 March 2022

152 Cabinet Office, [The National Resilience Strategy: A Call for Evidence](#), July 2021

“It sets out broad principles and the generic frameworks that support the tackling of all risks. It will be ambitious, with greater openness about risk and more action on prevention rather than simply waiting for emergencies to occur and curing the problem instead of prevention. It will also be ambitious in its whole of society approach, recognising that it is not simply about government getting everyone out of a hole when there is an emergency, but about everyone acting in concert to prevent and deal with emergencies when they happen.”<sup>153</sup>

As we outlined in Chapter 3, the National Resilience Strategy has been delayed repeatedly, but is now expected to be published before the end of the year.

90. In a theme becoming far too recurrent in JCNSS reports, we have found that the Government has very little grip on a critical national security risk. Climate risks have previously been categorised as Tier 1 national security risks, but a grave lack of ministerial responsibility and accountability has left a gaping hole at the centre of Government on this pressing future risk to UK CNI. The Government has broadly accepted that these shortfalls exist, with its latest climate change risk assessment finding that its actions on climate adaptation have not been sufficient, and that a “lack of clarity on ownership of risks and responses” has exacerbated this situation.

91. We expressed serious concerns about the previous Prime Minister’s more casual approach to national security, which included stepping back from regularly chairing the National Security Council. Through her new Foreign Policy and Security Council, we sincerely hope that the new Prime Minister will get a much better grip on the UK’s national security, empowering the Cabinet Office to play a stronger role in coordinating cross-government action, including on climate adaptation and CNI resilience.

92. *We recommend that the Prime Minister wastes no time in publishing the crucial and long-awaited National Resilience Strategy (NRS), which has the potential to ‘mainstream’ climate adaptation planning across Government, and to improve central Government oversight of risk assessment and risk planning more broadly. In the context of recent moves to disband the Civil Contingencies Secretariat, she must also ensure that the Cabinet Office has the proper resources and structures to implement the NRS effectively.*

93. The next National Adaptation Programme is also a critical opportunity to enhance the resilience of UK CNI to the effects of climate change. *To improve join-up between the Government’s parallel programmes on resilience and adaptation, we recommend that the new Minister for CNI Resilience and Defra’s Minister for Climate Adaptation meet on a regular basis—every six weeks at a minimum—to ensure that the NAP delivers a clear programme of activity to enhance the resilience of UK CNI to the effects of climate change and extreme weather. The 2023 NAP should draw strongly on the recommendations made in this report, and on those generated by the National Infrastructure Commission and the Climate Change Committee. The two Ministers should report to us jointly by the end of March 2023 on progress against this recommendation.*

## 5 Local resilience forums

94. Extreme weather events typically have a localised impact. Regardless of whether or not they elicit a national Government response, the immediate effects of the event are felt most acutely by local services and citizens, who may find themselves without power or access to communications, or facing major transport disruptions. Responsibility for planning and responding to such events falls to local resilience forums (LRFs). This chapter considers the role of LRFs in planning for climate-related emergencies locally, and their capacity to do so effectively. We took evidence from LRF representatives in January 2022, but we also base our findings on the detailed conclusions of the Lords RARP Committee’s 2021 report, and on the Government’s recent review of the Civil Contingencies Act (CCA).

### Box 7: What are local resilience forums?

Local resilience forums (LRFs) are multi-agency partnerships comprising representatives from local public services, responsible for planning and preparing for localised emergencies and incidents.

LRF members include the emergency services, local authorities, the NHS and the Environment Agency. Such “Category 1 responders” are subject to the full set of civil protection duties under the Civil Contingencies Act, which includes duties to “assess the risk of emergencies occurring and use this to inform contingency planning”, put in place emergency plans, and share information with other local responders to enhance co-ordination. LRFs are supported by other organisations known as Category 2 responders, such as public utility companies, which have a responsibility to co-operate with Category 1 organisations and to share relevant information with the LRF. The geographic areas covered by the forums are based on police areas.

Local Resilience Forums (England and Wales), Regional Resilience Partnerships (Scotland) and Emergency Preparedness Groups (Northern Ireland) are all tasked with compiling Community Risk Registers (CRRs). Central Government provides guidance on how risks should be evaluated, so that CRRs are broadly comparable to one another. The National Risk Register (the public-facing version of the NSRA) is used as part of the evidence base to develop these local risk assessments.<sup>154</sup> When an extreme weather event or another local emergency occurs, LRFs typically provide information or guidance to the public and take actions to ensure that services can continue operating, and that local people are supported.<sup>155</sup>

### Key LRF challenges

95. We found worrying evidence about LRFs’ ability to meet the wide-ranging demands placed upon them for preparing for and responding to extreme weather, particularly in relation to local CNI sites. John Hetherington, Head of London Resilience, told us that LRFs are “jacks of all trades and masters of none”, and are required to be “across every incident that may occur”, so “we do not have the time, resource, understanding, expertise or knowledge to look into any of these in real detail to truly understand them.”<sup>156</sup> He argued that what LRFs can achieve as local responders is “fairly limited” in relation to climate risks, adding: “We can foresee these issues, but we have very limited resources [...] to close those [risks] off”.<sup>157</sup>

154 POST briefing, [Evaluating UK natural hazards: the national risk assessment](#), 31 April 2019

155 For example: Kent Prepared website, [What is the Kent Resilience Forum?](#) Accessed 29 September 2022

156 [Q33](#)

157 [Q26](#)

96. The recent report by the Lords RARP Committee found that the risk landscape and expectations on LRFs have changed substantially since they were defined in the Civil Contingencies Act (CCA). Dr Fiona Twycross, Deputy Mayor for Fire and Resilience and Chair at London Resilience Forum, told the Committee that the CCA was “essentially designed to deal with civil contingencies, mainly short-term emergencies, whereas the thinking has now moved to a broader resilience agenda.”<sup>158</sup> She suggested that LRFs have become the “default tasking mechanism” in Whitehall for “anything that falls outside existing responsibilities”. In its conclusions, the Lords Committee agreed with her that LRFs should be placed on a statutory footing.<sup>159</sup>

97. Many of these findings echo the concerns that we expressed in our Biosecurity report in 2020. We found that LRFs had sometimes lacked the necessary intelligence, data and support from central government to carry out their role effectively during the Covid-19 pandemic, and we recommended that the Government establish a long-term plan for LRFs, including investment and wider support.<sup>160</sup> The Government did not reject our findings outright, but noted in its response that “lessons from recent events” would inform its review of the CCA, encompassing the roles and responsibilities of LRFs.<sup>161</sup> This review was subsequently published in April this year, and its findings are outlined below.

98. Funding challenges have also hindered LRFs’ capacity to fulfil the demands placed upon them. Local authorities’ spending power fell by 29% in real terms between 2010–11 and 2017–18, primarily driven by a 49% reduction in central Government funding.<sup>162</sup> As a result, local authority emergency planning expenditure in 2018–19 was 35% lower in real terms than in 2009–10, according to the Institute for Government.<sup>163</sup> The Lords RARP Committee consequently found that the increase in expectations on LRFs in recent years had not been accompanied by increased funding, and called for ring-fenced funding to be provided to LRFs.

99. These funding reductions—accompanied by the national Government’s focus on net zero—may explain why Stuart Marshall, Manager of Cleveland LRF, told us that the past ten years had seen a shift away from comprehensive work being undertaken regionally on climate adaptation. He told us that the focus is now on “energy conservation” and the path to net zero instead.<sup>164</sup>

100. Funding challenges might also explain why the military is often drafted in to lead the response to extreme weather events. During Storm Arwen, for example, 297 personnel from the Army and the Royal Marines were deployed to conduct door-to-door checks on vulnerable people, and to provide “reassurance to local communities”.<sup>165</sup> Planned cuts to the armed forces and increased global instability, including the war in Ukraine, may restrict the extent to which this sort of support can (or should) be provided in future.<sup>166</sup>

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158 [Q222](#) (Dr Fiona Twycross), Risk Assessment and Risk Planning Committee, 19 May 2021

159 House of Lords Risk Assessment and Risk Planning Committee, [Preparing for Extreme Risks: Building a Resilient Society \(HL110\)](#), 3 December 2021

160 JCNSS, [Biosecurity and national security \(HC611/HL195\)](#), 18 December 2020

161 JCNSS, [Biosecurity and national security: Government Response to the Committee’s First Report of Session 2019–21](#), 2 March 2021

162 NAO ‘Insight’, [Local government in 2019: a pivotal year](#), 13 February 2019

163 Institute for Government, [How fit were public services for coronavirus?](#) August 2020

164 [Q28](#) (Stuart Marshall)

165 HM Government press release, [Armed Forces support Storm Arwen response in Scotland and northern England](#), 4 December 2021

166 House of Commons library ‘Insight’, [UK Army to be reduced to 72,500](#), 23 March 2021

## The Government's response to these challenges

101. Many of the challenges outlined above were highlighted by the Government's own review of the Civil Contingencies Act, which examined the role of LRFs. It found that there are "challenges" in "the level of engagement", the role of the chair and how resilience activities are coordinated, and additional problems linked to accountability, assurance and levels of investment. The review concluded that:

- "Funding is a barrier" for LRFs in England: limited resources and reliance on partner budgets has an impact on preparedness, and the ability of organisations to collaborate effectively;
- Local responders "want clearer expectations on the roles and responsibilities of LRFs"; and
- There is a need for "enhanced accountability" for the multi-agency preparedness activities conducted by LRFs. More specifically, there is a "clear gap" in "who is accountable for ensuring how all these component parts come together", and for "maintaining effective cross-agency planning".

The review noted that an "LRF reform programme", led by the Department for Levelling Up, Housing and Communities (DLUHC), would "determine the future role of legislation", including any potential changes to the CCA.

102. The Government has also recognised that LRFs are underfunded, and has taken some steps to address it. In 2020–21, the Department for Levelling Up, Housing and Communities (DLUHC) piloted additional core funding of £7.5million for LRFs, and it has recently committed to a further three years of funding. According to a recent letter from the Cabinet Office to Lord Harris, Chair of the National Preparedness Commission, "DLUHC will continue to review funding arrangements for LRFs, including as part of their Integrated Review commitment to consider strengthening the roles and responsibilities of LRFs in England".<sup>167</sup> The Government has yet to announce any legislative changes, but they may form part of the forthcoming National Resilience Strategy.

**103. Local resilience forums (LRFs), which are essential to the local response to extreme weather events, have been inadequately resourced for too long. The findings of the Government's recent review of the Civil Contingencies Act (CCA) are therefore welcome, along with its recent recognition that unprecedented demands have been placed on LRFs in recent years. We also welcome the additional funding provided to LRFs over the next three years by the Department for Levelling Up, Housing and Communities (DLUHC). We will follow up with LRF representatives in six months' time, to establish whether this has been sufficient to address the significant challenges that they face.**

**104. When critical national infrastructure is impacted by extreme weather, the actions of local responders are absolutely vital for maintaining the health and security of local people. We welcome the Government's recognition of the need for reform, under a specific programme led by DLUHC. However, we recommend that the LRF reform**

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<sup>167</sup> [Letter dated 21/07/2022 from Lord True to Lord Harris of Haringey](#), regarding Local Resilience Forum funding and the work of the Civil Contingencies Secretariat, as discussed following the Oral Statement on Heatwave Response. (House of Lords Deposited Paper DEP2022–0692)

*programme considers specifically the role of LRFs in overseeing local CNI vulnerabilities to extreme weather and other effects of climate change, including the likely impact locally of extreme weather events. As recommended by the Lords Risk Assessment and Risk Planning Committee, the Government should also establish a much clearer statutory remit for LRFs, via reforms to the Civil Contingencies Act. Finally, we expect to see clear join-up between the DLUHC programme and the Cabinet Office's new emergency response and resilience structures; the Government should outline to us, in its response to this report, how the Cabinet Office will remain engaged in local emergency planning.*

## Information-sharing and exercising at the local level

105. Local resilience forums also face challenges in obtaining information from the Government: the CCA review found that the local relationship with central Government “and vice versa” could be “better aligned”. Some local partners regard the relationship is one way, “with the government able to call on local responders for information but not always reciprocating data sharing”. Defra hosts a Local Adaptation Advisory Panel (LAAP), which was established in 2010 “to facilitate dialogue between central government and a number of councils across England on how to best support local adaptation action”.<sup>168</sup> The LAAP only has 15 members, however, so the vast majority of local authorities are not represented.<sup>169</sup>

106. Beyond the LAAP, there are few formal mechanisms for information sharing, either at a national-to-local level or between the private and public sector.<sup>170</sup> In its 2021 Progress Report to Parliament, the Adaptation Committee referred to a survey by the CCC of LRFs, undertaken to inform its report. Two thirds of respondents said that information on interdependencies between local infrastructure sectors could be improved; 59% wanted more information on risks to digital and IT infrastructure, and almost half were concerned about local electricity networks.<sup>171</sup>

107. Exercises could form one part of the solution to this problem. The Integrated Review committed to improving the UK's “ability to test and develop our capabilities through contingency planning and regular exercises, bringing together government, the emergency services, the armed forces, other local responders and industry”. It is unclear whether the Government has subsequently carried out any exercises linked to CNI resilience or climate change: they were not mentioned in the Government's written evidence, but we were told in June 2021 that the Government would re-establish a comprehensive National Exercise Programme during 2022 to reflect NSRA priorities, with exercises having focused primarily on EU exit and Covid-19 risks since 2019.<sup>172</sup> The Government's response to our Biosecurity report also assured us that exercising “remains an important part of testing plans and procedures” for LRFs.<sup>173</sup>

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168 Cabinet Office (NIC0015)

169 Defra, [Preparing for a changing climate: Good practice guidance for local government](#), June 2019

170 Environment Agency (NIC0014)

171 Climate Change Committee, [Progress in adapting to climate change: 2021 Report to Parliament](#), June 2021

172 Written evidence on the UK's national security machinery from Stephen Lovegrove, then National Security Adviser (NSM0032)

173 JCNSS, [Biosecurity and national security: Government Response to the Committee's First Report of Session 2019–21](#), 2 March 2021

**Box 8: Exercises**

Cabinet Office guidance describes an exercise as a “simulation of an emergency situation”. Exercises have three main purposes: to validate plans, to develop staff competencies and give them practice in carrying out their roles in the plans, and to test established procedures.<sup>174</sup> The Government told us last year that the “flexibility, sophistication and pace” of its exercising had “improved substantively” in recent years, enabling it to test contingency plans and “validate and rehearse capabilities and arrangements”.<sup>175</sup>

108. Exercises could also clarify the roles and responsibilities for preparation and response to extreme weather at a national, regional and local level. Roger Hargreaves told us that the LRFs’ engagement with “the national level” is “particularly important” for managing climate-related risks to CNI,<sup>176</sup> and indicated that the National Resilience Strategy would address the question of “how the local level and the central level work together”.<sup>177</sup>

**109. The Government’s review of the CCA recognised the need for greater clarity on the roles and responsibilities of LRFs. We recommend that the Government oversees a programme of ‘exercises’ to plan for major regional extreme weather events with multiple cascading effects. It should involve local and regional actors in these exercises, including key CNI operators, and use them to clarify and communicate roles and responsibilities at a national, regional and local level. When it responds to this report, the Government should also outline, in confidence if necessary, its plans for CNI-related exercises involving local actors. If necessary, we will follow up with LRFs in six months’ time, to establish whether such a programme is underway.**

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174 Cabinet Office Guidance, [Emergency planning and preparedness: exercises and training](#), 11 November 2014

175 Written evidence on the UK’s national security machinery from Stephen Lovegrove, then National Security Adviser ([NSM0032](#))

176 [Q96](#)

177 [Q97](#)

## 6 Funding climate adaptation and resilience

110. Storm Arwen caused approximately £250–300million in insurance losses,<sup>178</sup> and resulted in compensation payments of around £44million to customers from energy companies.<sup>179</sup> A number of witnesses highlighted evidence that greater investment in climate adaptation could prevent such large, crisis-induced costs from materialising,<sup>180</sup> but we also found major obstacles to funding adaptation. This chapter considers the funding picture for climate adaptation and CNI, including the role of the Government, regulators and private sector in ensuring sufficient investment in infrastructure adaptation.

111. The Government recognises that early adaptation efforts save money. Its third CCRA noted that a cost-benefit analysis had found that that “many early adaptation investments are highly effective and deliver high value for money”, with benefit-cost ratios typically ranging from 2:1 to 10:1—meaning that every £1 invested in adaptation could result in £2 to £10 in net economic benefits.<sup>181</sup> Adaptation leads to “important co-benefits”, too: “as well as reducing potential losses from climate change, it often generates direct economic gains, or leads to social or environmental benefits”.<sup>182</sup> It nevertheless requires investment, whether via the operator, consumer or taxpayer. The current cost of living crisis has made this even more challenging, with many operators facing huge rises in running costs, and four in ten people already struggling to pay their food and energy bills.<sup>183</sup>

### Investment in infrastructure and adaptation

#### *Existing operators’ investment plans*

112. Given that there is no regulatory requirement on many CNI operators to plan for climate change, as discussed in Chapter 3, it is unsurprising that many do not feel incentivised to invest in adaptation. Witnesses suggested that climate risks are often still seen as a hindrance or an added cost, rather than an investment;<sup>184</sup> academics also told us that there is “mounting pressure” on operators to “maintain good performance levels with a decreasing budget”, particularly since the Covid-19 pandemic.<sup>185</sup>

113. Those operators who provided evidence seemed uncertain about their long term funding picture, lacking confidence that they would have the resources to adapt to climate change. For example:

- **Telecoms:** techUK raised concerns within the telecoms sector about the extent of resilience-building possible “without appropriate and fair funding models”.

178 PwC press release, [Storm Arwen costs could top £250 million - PwC](#) (undated, accessed 30 September 2022)

179 *The Guardian*, [Power firms must ‘up their game’ after Storm Arwen failures, says Ofgem](#), 9 June 2022

180 For example: Environment Agency ([NIC0014](#))

181 HM Government, [UK Climate Change Risk Assessment 2022](#), 17 January 2022

182 *Ibid*

183 YouGov, [Cost of living crisis: one in four have had to cut essential spending](#), 25 August 2022

184 [Q8](#) (Dr Swenja Surminski)

185 Dr Suresh Renukappa (Senior Lecturer at University of Wolverhampton); Mr Luke Seabright (Researcher at University of Wolverhampton); Dr Subashini Suresh (Reader at University of Wolverhampton) ([NIC0022](#)), “Recommendations”, bullet point 2

The sector is concerned that a lack of “fair and equitable” funding models could result in an “uneven burden” on certain providers to upgrade infrastructure—for example, based on the different risk factors in different parts of the country.<sup>186</sup>

- **Water:** Nevil Muncaster from Thames Water predicted that their maintenance costs would increase as a result of climate change, “because our assets will have to work harder and maybe to more extreme limits”.<sup>187</sup>
- **Rail:** Network Rail’s Martin Frobisher said that the organisation was in a “good position” in relation to funding for resilience-building in the short to medium term, but he suspected that “in the longer term there will be some issues.”<sup>188</sup>

114. The ORR similarly identified funding constraints as one of the obstacles to “optimal decision-making” on climate adaptation in the transport sector.<sup>189</sup> It argued that the scope for proactive investment, to align with current and future weather patterns, is limited because “both road and rail are largely funded by the taxpayer”.<sup>190</sup> As the impact of climate change increases in the future, so too will the frequency of delays and disruptions on the railway.<sup>191</sup> It added:

“If this reduced performance is not acceptable then more needs to be done to enhance asset resilience. How far we go in designing resilient assets in part depends on how much funding is available as it is not going to be affordable to rebuild all railway embankments.”<sup>192</sup>

### ***New infrastructure investments***

115. The Environment Agency told us that adaptation and resilience measures should be embedded into all publicly and privately funded infrastructure projects. It noted that nearly £650 billion of infrastructure investment is planned by 2030, according to the Infrastructure and Projects Authority’s 2021 Analysis of the National Infrastructure and Construction Pipeline—over £200 billion of which will occur by 2024/25. During the same period, around £3 billion will be invested in flood and coastal risk management infrastructure. The Agency argued that “£3 billion worth of investment in flood defences cannot secure the resilience of £200 billion worth of wider infrastructure investment”.<sup>193</sup> The long intended lifespan of new infrastructure makes adaptation all the more important: Treasury guidance suggests that civil servants’ cost-benefit calculations on new infrastructure projects should be appraised over a 60-year period,<sup>194</sup> meaning that new UK CNI should be designed for climate change outcomes up to at least 2082.

116. One potential mechanism for encouraging adaptation investment for new CNI projects is the UK Infrastructure Bank (UKIB). Launched officially in June 2022, the UKIB is operationally independent, but works with HM Treasury. Its dual objectives are

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186 Tech UK (NIC0025), para 5.1.

187 Q59 (Nevil Muncaster)

188 Q59 (Martin Frobisher)

189 Office of Rail and Road (NIC0017)

190 Office of Rail and Road (NIC0017)

191 Network Rail (NIC0012)

192 Network Rail (NIC0012)

193 Environment Agency (NIC0014), paras 20–21

194 Government Finance Function and HM Treasury, [The Green Book \(2022\)](#), updated 30 March 2022

to support regional economic growth and to “help mitigate and adapt to climate change”.<sup>195</sup> The framework document notes that there may occasionally be conflicts between the Bank’s growth objective and its climate aims; in that case, “where an investment is primarily to support economic growth, the Company will ensure that it does not do significant harm against its climate objective.”<sup>196</sup>

117. The Government’s recent Growth Plan also makes major commitments on the delivery of new CNI. Unfortunately it contains no reference at all to adaptation, however. It states that the Government will liberalise the planning system to accelerate the construction of vital infrastructure projects, “streamlining consultation and approval requirements”; this will include “reducing the burden of environmental assessments” and “reforming habitats and species regulations”. It separately provides a list of infrastructure projects that will be prioritised for “acceleration”, including 86 road projects, ten rail projects and 21 energy projects. More promisingly, the Plan commits to prioritising delivery of National Policy Statements for energy, water resources and national networks. National Policy Statements set out the Government’s objectives for significant infrastructure projects, and must consider “the desirability of mitigating, and adapting to, climate change”.<sup>197</sup>

**118. The establishment of the UK Infrastructure Bank is a welcome development, given its specific mandate to help the UK to adapt to climate change. It is vital that this remains at the forefront of the Bank’s investment decisions, with adaptation projects prioritised as much as those targeted towards mitigation and/or regional economic growth. We recommend that the UKIB’s annual report outlines specifically how the Bank has met its adaptation objectives, including projects that will enhance UK CNI’s resilience to the effects of climate change and extreme weather.**

**119. The Government’s Growth Plan commits to accelerating the construction of a large number of critical national infrastructure projects, including by “reducing the burden of environmental assessments”. Given the shortfalls outlined in this report, it is essential that the Growth Strategy does not reduce investment in—or requirements for—proper adaptation planning. In that context, we welcome the Plan’s commitment to producing National Policy Statements for significant sectors, which must include a consideration of adaptation requirements. The Government should also commit to us, in writing, that its planned acceleration of infrastructure investment and approvals will not be to the detriment of improvements to climate adaptation planning and investment.**

## Consumer costs and the role of regulators

120. Sir John Armitt noted that operators tend to undertake regular analyses of key risks to business as part of their day-to-day activities, but said that assessing low-probability, high-impact risks poses a significant challenge to them.<sup>198</sup> In relation to those risks, he said, “utility companies are looking over their shoulders at the regulator”, which for the last 20–30 years have focussed on “making sure that these guys are super-efficient and are keeping their costs down”.<sup>199</sup>

195 HM Treasury and UK Infrastructure Bank, [UK Infrastructure Bank Framework Document](#), p.4, 17 June 2022

196 *Ibid*

197 DLUHC Guidance, [Planning Act 2008: Guidance on the process for carrying out a review of existing National Policy Statements](#), 20 May 2021

198 [Q4](#) (Sir John Armitt)

199 [Q4](#) (Sir John Armitt)

121. Many CNI operators are part of regulated markets, and are subject to price controls to ensure fair competition and protect consumers. Ofgem, for example, claims that price control regulation encourages efficiency, ensures that monopolies do not abuse their position, and provides companies with “a future level of revenue and appropriate incentives to meet their statutory duties and licence obligations”. It gathers a large amount of data, including company financial statements and customer surveys, to inform the price that it permits energy companies to charge for power.<sup>200</sup> (The price control process is separate from—but linked to—the price cap mechanism: price cap rises have allowed energy operators to pass on rises in wholesale energy prices to consumers, through a series of increases in the maximum per unit price of energy).

122. Some operators suggested that the price controls set by regulators do not give them the flexibility to deal with unforeseen events, nor to tackle the unpredictable effects of climate change. Network Rail’s written evidence suggested that a shift in approach to financing resilience was required:

“Careful consideration should be given to encouraging CNI operators, their funders and their regulators, to determine resilience requirements based on sound risk management practices and not to value current financial saving/efficiency over current and future resilience.”<sup>201</sup>

123. In the NIC’s 2020 report on infrastructure resilience, it called on regulators to set out, in future price reviews, how their determinations are consistent with meeting standards of resilience in both the short and long term.<sup>202</sup> The Government responded that it would neither accept nor reject the recommendation until the National Resilience Strategy has been finalised. The current Prime Minister subsequently announced that energy regulation more broadly would be reviewed, to ensure that it addresses “supply and affordability for the long term”.<sup>203</sup>

**124. The current price review mechanisms for utility companies may be unsuitable for ensuring investment in long term resilience. We welcome the Prime Minister’s recently-announced review of energy regulation, but we recommend that the Government goes further, undertaking an urgent review of price control mechanisms across all relevant infrastructure sectors. This should consider specifically their suitability for ensuring investment in CNI resilience and climate adaptation, in time to inform the next set of price reviews.**

## The Government’s role in driving adaptation investment

125. Both regulators and operators suggested that they would benefit from greater clarity from the Government about how much they should be spending on climate adaptation and resilience. For example:

- Dr Charlotte Ramsay from Ofgem told us that a conversation had to be held with the Government about “what kind of risks we are prepared to take”, and about “the distribution of costs”.

200 Ofgem factsheet, [Update: What is a price control?](#) (undated, accessed 30 September 2022)

201 National Infrastructure Commission, [Anticipate, React, Recover: Resilient infrastructure systems](#), May 2020

202 National Infrastructure Commission, [Anticipate, React, Recover: Resilient infrastructure systems](#), May 2020

203 HC Debate, UK Energy Costs, Vol 719 [Col 403](#), 8 September 2022

- The Energy Networks Association, a membership body for energy companies, called for “open discussion and engagement” to better understand how resilience standards can adapt to protect CNI in future, the costs that would be incurred to achieve these standards, and how these costs should be spread in a way that is fair to consumers.<sup>204</sup>
- Sir John Armitt said that the Government will ultimately “have to grasp the nettle” and ask what resilience standards are regarded as acceptable, and what will be “the acceptable cost consequences to the consumer, who will pay as the taxpayer or at the point of use”.<sup>205</sup>

126. Many operators will find it hard to quantify the savings that might be generated from adaptation investment in their specific type of infrastructure: the upfront costs might be high, and the precise impact of climate change is uncertain. The Environment Agency has called for the Treasury to undertake a review into the economics of adaptation, which would “help improve our understanding of how climate resilience can support sustainable economic growth”. This could “form the basis of a domestic strategy for climate adaptation and more efficient join up between resilience and net zero”. It suggests that this could consider:

- The optimal costs and benefits of investing in resilience, both nationally and by economic sectors;
- What trajectory that investment should follow; and
- The appropriate balance between public and private investment in resilience.

127. Roger Hargreaves acknowledged that the overall spend on resilience needed to increase, and conceded that some of that increase should be through placing greater demands on regulated sectors, “where appropriate”. He also acknowledged that a “framework” might be needed for investment in resilience, so that “anyone else who wants to invest understands where the priorities should be against a common set of risks”.<sup>206</sup>

128. One such “framework” could involve the insurance industry. In the early 1990s, the insurance market pulled out of the terrorism market entirely, after a series of IRA attacks on financial targets and city centres. The Government of the day stepped in, providing an unlimited guarantee that has (as yet) never been called upon. The insurance industry ‘pools’ its risk into the fund (Pool Re), enabling insurers to provide cover against terrorism attacks. A percentage of the fund can also be spent on broader resilience measures to protect organisations against terrorism. This could provide a model for other forms of major systemic risk, including climate change. While the risk of an unlimited guarantee may be too high, other forms of private-public partnership could be explored.

**129. In light of the cost-of-living crisis and the increasing impact of climate change on CNI, it is essential that the Government, regulators and operators consider carefully how to spread the costs of adaptation, ensuring that it does not affect financially vulnerable customers. There is nevertheless a grave risk that these shorter-term affordability pressures result in inadequate longer-term investment in resilience and**

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204 Energy Networks Association ([NIC0032](#)), TOR 3 – acceptable levels of resilience

205 [Q6](#) (Sir John Armitt)

206 [Q101](#)

adaptation, incurring far greater costs later on. There are difficult trade-offs to manage between affordability and resilience, but with no central oversight at present, and very little public awareness of the risks that are being taken.

130. The Government's own climate change risk assessment notes that early adaptation efforts deliver high value for money. *We recommend that the Government undertakes a more detailed cost-benefit analysis of climate adaptation for every CNI sector, using the results to inform the resilience standards recommended in Chapter 3. It should also consider a more wide-ranging review into the economics of adaptation, as recommended by the Environment Agency.*

131. The Government works in partnership with the insurance industry to ensure cover for terrorist attacks, with an unlimited guarantee from HM Treasury. A percentage of this insurance pool—managed by Pool Re—is invested in resilience measures. This could serve as a model for an insurance-based scheme to encourage CNI operators to invest in resilience to the changing climate, as another major systemic risk. *We recommend that the Government engages with insurance providers to explore options for a public-private insurance partnership to incentivise investment in climate adaptation measures, in conjunction with resilience standards and other forms of central Government oversight. It should report back to us with its findings in six months' time.*

132. Our previous reports have found significant problems with the Government's preparations for risks that have the potential to wreak havoc on the UK economy and society. While we are acutely aware of the very difficult fiscal climate, it is high time that the Government learned that prevention is better than cure. We can already see the significant effects of climate change; if we do not invest time, efforts and resources in climate adaptation—particularly to enhance the resilience of our critical national infrastructure—then there will be an enormous price to pay in future, and that price will not only be paid in money.

# Conclusions and recommendations

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## Introduction and context

1. The evidence is overwhelming that the effects of climate change on our critical national infrastructure are already significant, and are set to worsen substantially under all reasonable climate change scenarios. Buckling train lines, flooding of major infrastructure sites, landslides and power outages are all realistic outcomes. They may also happen simultaneously, causing multiple cascading effects across different infrastructure sectors. The scale of the challenge facing Government, operators and regulators is clear: there is an urgent need to adapt our infrastructure to the potentially rapid effects of climate change. (Paragraph 10)
2. When we launched this inquiry, climate adaptation had been described as the ‘Cinderella’ of climate change, compared with climate mitigation and the path to net zero. Approaching the vital COP26 summit, we saw much-needed discussion about actions to decarbonise the UK economy and cut greenhouse emissions for the future, but little attention was paid to the effects of climate change already incurred. During the course of our inquiry, however, the UK experienced major weather events such as Storm Arwen, including extensive power outages and a knock-on effect on communications. We concluded our inquiry in the midst of an unprecedented heatwave, taking evidence from Government Ministers and officials while the country faced significant rail disruptions, flight delays and power cuts. These events have moved climate adaptation more firmly into the public eye and demonstrated that poor adaptation poses a threat to UK national security, but they have also shone a light on an alarming lack of Government action in this vital area. (Paragraph 19)

## Key adaptation challenges: interdependencies and information-sharing

3. The UK’s critical national infrastructure (CNI) is fundamental to the smooth running of the economy and of society. It is becoming increasingly interconnected, and all CNI sectors are heavily reliant on a stable energy supply. The Covid-19 pandemic demonstrated how rapidly the impact of a hazard can spread—or cascade—from one part of society to another. The same is true of the effects of climate change, as extreme weather events in the past year have shown. Yet we have found very little join-up between CNI sectors, with no formal mechanism for collaboration or information-sharing on interdependencies. This has resulted in some worrying near misses and an apparent lack of planning and foresight. (Paragraph 33)
4. The Government has begun to recognise the risks posed by the extensive interdependencies between CNI sectors. There is some promising work underway on the development of ‘digital twins’ to model climate-related infrastructure interdependencies, on which we would welcome further Government investment. The new CNI Knowledge Base is also a very positive development. It remains to be seen, however, how the Government will connect this vital analysis to infrastructure operators and regulators, whether operators will be held to account on their responses, and how the Knowledge Base will inform policy-making on climate adaptation. The

Government also has unique powers to establish other mechanisms to improve oversight of interdependencies overall—such as through joint reporting under the Adaptation Reporting Power—but it has so far failed to use them. (Paragraph 34)

5. *We recommend that the Government formalises collaboration between CNI regulators on climate adaptation, through a statutory forum chaired by a senior Government official (at Director General level), with key operators invited to meetings. This forum should publish an annual report to Parliament on key actions to address interdependencies and to enhance CNI resilience to climate change and extreme weather, utilising data and intelligence from the CNI Knowledge Base. The Government should also make use of the power granted by the Climate Change Act 2008 to require CNI operators and/or regulators to report jointly under the Adaptation Reporting Power.* (Paragraph 35)
6. The transition to net zero is vital, but it will result in the UK becoming increasingly reliant on electricity and renewable energy sources, which are more vulnerable to extreme weather than gas and other fossil fuels. Meanwhile, all other forms of CNI are heavily reliant on their energy supply, meaning that power outages have the potential to cause widespread economic and societal damage. Climate adaptation must be central to the Government's efforts to transition to low-carbon energy sources, and to enhancing the resilience of the UK's energy supply to global shocks. (Paragraph 41)
7. It is welcome that the Government undertook extensive work on energy resilience in the wake of Storm Arwen, but this was a reactive response to a national crisis resulting in widespread power outages lasting over a week, and necessitating military deployment. Ministers should have anticipated and been better prepared for such an event, through proactive adaptation efforts and proper crisis planning. This is demonstrative of wider shortfalls in Government risk management—as we outlined in our previous reports during this Parliament, on Biosecurity and the UK's national security machinery. We will return to this topic in Chapter 4. (Paragraph 42)
8. The Energy Bill is a vital opportunity to improve the resilience of the UK's energy supply, so we are concerned by reports that the legislation may be dropped—even as reports suggest that the UK could face energy shortages this winter. If the Bill is passed, the Independent System Operator and Planner (ISOP) would be tasked with carrying out strategic planning and forecasting in relation to electricity and gas transmission. *We would welcome the Government's assurances that the ISOP's mandate will include planning for the impact of the changing climate on the UK's energy supply. The Government's recently-announced review of energy regulation must also consider the extent to which the current regulatory regime allows for sufficient investment in resilience and adaptation, in line with the recommendations outlined in the final chapter of this report.* (Paragraph 43)
9. We welcome the development of the Cabinet Office's 'National Situation Centre' (SitCen), which gathers and generates real-time data to inform the Government's crisis and emergency response work—including on weather patterns. *We recommend, however, that the Government explores the potential for SitCen to generate longer-term climate data and analysis for CNI operators, to inform their climate adaptation planning efforts. This should be drawn from a wide range of sources, in light of the*

*significant uncertainties inherent in longer-term climate modelling. In the context of an open market for climate services, in which vital infrastructure operators could be relying on suboptimal weather and climate reports, this could ensure that operators and regulators are working to the same, quality-assured assumptions. It could also enhance their ability to collaborate on addressing cascading risks and interdependencies. (Paragraph 46)*

### Regulating CNI: resilience standards and stress testing

10. The regulatory landscape of CNI is extremely fragmented, with a variety of different approaches to climate adaptation and resilience. There are worryingly low levels of activity in some sectors, and some clear regulatory gaps, such as the fact that there is no oversight of the continuity of nuclear energy supply. We acknowledge that different sectors have different adaptation needs; nevertheless, this scattergun application of regulatory responsibilities is no longer tenable. (Paragraph 62)
11. In 2020, the National Infrastructure Commission (NIC) made strong, evidence-based recommendations to improve CNI regulation in relation to resilience, which would have been highly applicable to CNI operators' preparations for climate change. Unfortunately, the Government has delayed implementation of these reforms until its National Resilience Strategy (NRS) is published. The NRS itself has been delayed several times, despite being a key commitment of the Integrated Review over 18 months ago. The costs of failure are extremely high, as demonstrated by the fatal rail accident near Stonehaven in 2020; these ongoing delays to implementation are therefore extremely unfortunate. (Paragraph 63)
12. We note the Government's concerns about the complexity of the regulatory landscape and the difficulty of imposing a more uniform regulatory regime. We agree with the NIC, however, that resilience cannot be left entirely to the market. Indeed, our survey found that only a third of responding organisations planned more than a decade in advance for the effects of climate change. *We suggest that the Government undertakes more detailed work on international comparators in relation to regulatory regimes. In addition, in line with the NIC's 2020 report on resilience, we recommend that:*
  - *The Government should publish a full set of resilience standards every five years, for the sectors under the NIC's purview at a minimum (energy, water, digital, road and rail services); it should also examine how these could apply to other CNI sectors.*
  - *CNI regulators should require their operators to develop long-term resilience strategies;*
  - *Recognising that CNI should be tested regularly against a wide range of stresses, including interdependencies, regulators should oversee a programme of stress testing against a range of risks that might affect critical services; and*
  - *These resilience standards and stress tests should specifically address the effects of climate change in the short, medium and long term, to ensure that CNI operators are planning for a range of potential scenarios.*

### Ministerial oversight and cross-Government action

13. Having received two pieces of written evidence from the Minister for the Cabinet Office, then Michael Ellis, we were astounded when he subsequently refused to give evidence to us on a topic of such importance to the UK's national security and prosperity. We note that the then Defra Minister, Steve Double, stepped in at very short notice, having been in post for only ten days. We are also very grateful to Roger Hargreaves for providing helpful and informative oral evidence on the Cabinet Office's behalf. Their actions only serve to underscore what a dereliction of duty it was for Mr Ellis to refuse to appear before us—not only in relation to his willingness to be accountable to Parliament, but also in what it suggests about his commitment to deliver for the public that he serves. We can only hope that his successor will take more interest in this vital topic. (Paragraph 67)
14. It appears that there has been no single Minister taking responsibility for the immense challenge of adapting CNI to the effects of the changing climate, which has been falling through the cracks between Government departments. Despite chairing the Climate Action Implementation Committee, which was tasked with “building the United Kingdom's resilience to climate impacts”, Alok Sharma felt unable to give evidence on this topic. Mr Ellis admitted to us that he was not overseeing a central programme of work, but rather played a “convening role” in relation to the Government's written evidence. He also disclosed that he had never met the Defra Minister for Climate Adaptation to discuss CNI resilience to climate change, which may reflect the lack of any Ministerial forum to discuss this issue. (Paragraph 78)
15. The Government has rightly focused extensive efforts on the path to net zero, but the irreversible effects of climate change are already with us, and are set to worsen significantly. This requires prioritisation at the highest levels of Government. Defra told us that its team of officials are responsible for “picking out the interdependencies” between CNI sectors in relation to climate adaptation, and referring them to other departments. Critical vulnerabilities require more than just information-sharing between civil servants, however—they require clear ownership by Ministers, and the coordination and oversight that the Cabinet Office is usually expected to provide. It is hard to imagine this approach being applied to any other national security risk. (Paragraph 79)
16. *We recommend that the Government establishes a Minister of State for CNI Resilience and a team within the Cabinet Office to focus on this issue, across a range of national security threats and hazards. To drive forward this work across departments, the Government should also re-establish a Ministerial committee on resilience, following the recent abolition of the National Security Council and its sub-committees (including the Resilience sub-committee of National Security Ministers). This group should regularly consider both climate adaptation and CNI interdependencies, reporting to the Foreign Policy and Security Council on an annual basis.* (Paragraph 80)
17. In a theme becoming far too recurrent in JCNSS reports, we have found that the Government has very little grip on a critical national security risk. Climate risks have previously been categorised as Tier 1 national security risks, but a grave lack of ministerial responsibility and accountability has left a gaping hole at the centre of Government on this pressing future risk to UK CNI. The Government has broadly

accepted that these shortfalls exist, with its latest climate change risk assessment finding that its actions on climate adaptation have not been sufficient, and that a “lack of clarity on ownership of risks and responses” has exacerbated this situation. (Paragraph 90)

18. We expressed serious concerns about the previous Prime Minister’s more casual approach to national security, which included stepping back from regularly chairing the National Security Council. Through her new Foreign Policy and Security Council, we sincerely hope that the new Prime Minister will get a much better grip on the UK’s national security, empowering the Cabinet Office to play a stronger role in coordinating cross-government action, including on climate adaptation and CNI resilience. (Paragraph 91)
19. *We recommend that the Prime Minister wastes no time in publishing the crucial and long-awaited National Resilience Strategy (NRS), which has the potential to ‘mainstream’ climate adaptation planning across Government, and to improve central Government oversight of risk assessment and risk planning more broadly. In the context of recent moves to disband the Civil Contingencies Secretariat, she must also ensure that the Cabinet Office has the proper resources and structures to implement the NRS effectively.* (Paragraph 92)
20. The next National Adaptation Programme is also a critical opportunity to enhance the resilience of UK CNI to the effects of climate change. *To improve join-up between the Government’s parallel programmes on resilience and adaptation, we recommend that the new Minister for CNI Resilience and Defra’s Minister for Climate Adaptation meet on a regular basis—every six weeks at a minimum—to ensure that the NAP delivers a clear programme of activity to enhance the resilience of UK CNI to the effects of climate change and extreme weather. The 2023 NAP should draw strongly on the recommendations made in this report, and on those generated by the National Infrastructure Commission and the Climate Change Committee. The two Ministers should report to us jointly by the end of March 2023 on progress against this recommendation.* (Paragraph 93)

### Local resilience forums

21. Local resilience forums (LRFs), which are essential to the local response to extreme weather events, have been inadequately resourced for too long. The findings of the Government’s recent review of the Civil Contingencies Act (CCA) are therefore welcome, along with its recent recognition that unprecedented demands have been placed on LRFs in recent years. We also welcome the additional funding provided to LRFs over the next three years by the Department for Levelling Up, Housing and Communities (DLUHC). We will follow up with LRF representatives in six months’ time, to establish whether this has been sufficient to address the significant challenges that they face. (Paragraph 103)
22. When critical national infrastructure is impacted by extreme weather, the actions of local responders are absolutely vital for maintaining the health and security of local people. We welcome the Government’s recognition of the need for reform, under a specific programme led by DLUHC. *However, we recommend that the LRF reform programme considers specifically the role of LRFs in overseeing local CNI*

*vulnerabilities to extreme weather and other effects of climate change, including the likely impact locally of extreme weather events. As recommended by the Lords Risk Assessment and Risk Planning Committee, the Government should also establish a much clearer statutory remit for LRFs, via reforms to the Civil Contingencies Act. Finally, we expect to see clear join-up between the DLUHC programme and the Cabinet Office's new emergency response and resilience structures; the Government should outline to us, in its response to this report, how the Cabinet Office will remain engaged in local emergency planning. (Paragraph 104)*

23. The Government's review of the CCA recognised the need for greater clarity on the roles and responsibilities of LRFs. *We recommend that the Government oversees a programme of 'exercises' to plan for major regional extreme weather events with multiple cascading effects. It should involve local and regional actors in these exercises, including key CNI operators, and use them to clarify and communicate roles and responsibilities at a national, regional and local level. When it responds to this report, the Government should also outline, in confidence if necessary, its plans for CNI-related exercises involving local actors. If necessary, we will follow up with LRFs in six months' time, to establish whether such a programme is underway. (Paragraph 109)*

### Funding climate adaptation and resilience

24. The establishment of the UK Infrastructure Bank is a welcome development, given its specific mandate to help the UK to adapt to climate change. It is vital that this remains at the forefront of the Bank's investment decisions, with adaptation projects prioritised as much as those targeted towards mitigation and/or regional economic growth. *We recommend that the UKIB's annual report outlines specifically how the Bank has met its adaptation objectives, including projects that will enhance UK CNI's resilience to the effects of climate change and extreme weather. (Paragraph 118)*
25. The Government's Growth Plan commits to accelerating the construction of a large number of critical national infrastructure projects, including by "reducing the burden of environmental assessments". Given the shortfalls outlined in this report, it is essential that the Growth Strategy does not reduce investment in—or requirements for—proper adaptation planning. In that context, we welcome the Plan's commitment to producing National Policy Statements for significant sectors, which must include a consideration of adaptation requirements. *The Government should also commit to us, in writing, that its planned acceleration of infrastructure investment and approvals will not be to the detriment of improvements to climate adaptation planning and investment. (Paragraph 119)*
26. The current price review mechanisms for utility companies may be unsuitable for ensuring investment in long term resilience. *We welcome the Prime Minister's recently-announced review of energy regulation, but we recommend that the Government goes further, undertaking an urgent review of price control mechanisms across all relevant infrastructure sectors. This should consider specifically their suitability for ensuring investment in CNI resilience and climate adaptation, in time to inform the next set of price reviews. (Paragraph 124)*
27. In light of the cost-of-living crisis and the increasing impact of climate change on CNI, it is essential that the Government, regulators and operators consider carefully

how to spread the costs of adaptation, ensuring that it does not affect financially vulnerable customers. There is nevertheless a grave risk that these shorter-term affordability pressures result in inadequate longer-term investment in resilience and adaptation, incurring far greater costs later on. There are difficult trade-offs to manage between affordability and resilience, but with no central oversight at present, and very little public awareness of the risks that are being taken. (Paragraph 129)

28. The Government's own climate change risk assessment notes that early adaptation efforts deliver high value for money. *We recommend that the Government undertakes a more detailed cost-benefit analysis of climate adaptation for every CNI sector, using the results to inform the resilience standards recommended in Chapter 3. It should also consider a more wide-ranging review into the economics of adaptation, as recommended by the Environment Agency.* (Paragraph 130)
29. The Government works in partnership with the insurance industry to ensure cover for terrorist attacks, with an unlimited guarantee from HM Treasury. A percentage of this insurance pool—managed by Pool Re—is invested in resilience measures. This could serve as a model for an insurance-based scheme to encourage CNI operators to invest in resilience to the changing climate, as another major systemic risk. *We recommend that the Government engages with insurance providers to explore options for a public-private insurance partnership to incentivise investment in climate adaptation measures, in conjunction with resilience standards and other forms of central Government oversight. It should report back to us with its findings in six months' time.* (Paragraph 131)
30. Our previous reports have found significant problems with the Government's preparations for risks that have the potential to wreak havoc on the UK economy and society. While we are acutely aware of the very difficult fiscal climate, it is high time that the Government learned that prevention is better than cure. We can already see the significant effects of climate change; if we do not invest time, efforts and resources in climate adaptation—particularly to enhance the resilience of our critical national infrastructure—then there will be an enormous price to pay in future, and that price will not only be paid in money. (Paragraph 132)

## Annex: Joint Committee on the National Security Strategy

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The Members of the Joint Committee which conducted the inquiry were:

- Margaret Beckett MP (Chair)
- Baroness Anelay of St Johns
- Lord Butler of Brockwell
- Sarah Champion MP
- Baroness Crawley
- Lord Dannatt
- Tobias Ellwood MP
- Richard Graham MP
- Baroness Hodgson of Abinger
- Diana Johnson MP
- Darren Jones MP
- Alicia Kearns MP
- Angus Brendan MacNeil MP
- Stephen McPartland MP
- Sir Robert Neill MP
- Baroness Neville-Jones
- Lord Reid of Cardowan
- Lord Snape
- Bob Stewart MP
- Viscount Stansgate
- Lord Strasburger
- Tom Tugendhat MP

The following Members were discharged from the Committee during the inquiry:

- Lord Brennan (January 2022)
- Baroness Healy of Primrose Hill (January 2022)

- Baroness Henig (January 2022)
- Lord King of Bridgwater (January 2022)
- Lord Laming (January 2022)
- Baroness Lane-Fox of Soho (January 2022)

## **Declarations of interest (Lords)<sup>207</sup>**

The following interests, relevant to this inquiry, were declared:

### **Baroness Anelay of St Johns**

Trustee, Parliamentary Human Rights Trust [non-financial]

Member of the All-Parliamentary Parliamentary Group for the Armed Forces, which includes breakfast and dinner briefings totalling no more than £300 in value over the course of the year, paid for by sources listed in the register of APPGs

Chair (formerly Chair-designate), United Nations Association - UK (UNA-UK)

### **Lord Butler of Brockwell**

Adviser, TT International plc (investment management) (interest ceased 30 April 2021) (remunerated)

Member, King's College London Campaign Board (non-financial)

### **Baroness Crawley**

Vice-President, War Widows Association (non-financial)

### **Lord Dannatt**

Chairman and Director, Cadence Consultancy Ltd (directorship)

Director, Mill House Partners 2012 Limited (publishing) (directorship)

International Advisory Board, Photonis Netherlands BV (remunerated)

Senior Adviser giving marketing advice in relation to large organisations running major projects in the private and public sector, FileSwap Global (artificial intelligence company which specialises in document handling) (remunerated)

Senior Adviser, Joule Africa (remunerated)

Mill House Partners 2012 Limited (see category 1) (company control)

Chairman, National Emergencies Trust (non-financial)

Chairman, Norfolk Strategic Flooding Alliance (non-financial)

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207 The declaration of interests by the Commons Members are available in the Committee's [Formal Minutes 2022–23](#).

**Baroness Hodgson of Abinger**

Co-chair of APPG for Women, Peace and Security

Member of steering board of Preventing Sexual Violence in Conflict Initiative (PSVI)

Trustee, the Chalker Foundation

Honorary Colonel of Outreach Group, 77th Brigade

Coordinator of Afghan Women's Support Forum

Member, APPG for the Armed Forces

Trustee of the Armed Forces Parliamentary Trust

**Baroness Neville-Jones**

No relevant interests declared

**Lord Reid of Cardowan**

Director/shareholder, John Reid Advisory Ltd (risk management; homeland security strategy)

Chairman, Institute for Strategy, Resilience and Security, University College London

Chair, Advisory Board, Shearwater Group plc (digital resilience/cyber security)

**Lord Snape**

Attendance at Annual Meeting of Institute of Travel and Tourism held on board MSC Virtuosa travelling around UK territorial waters, 10-13 September 2021; travel and accommodation costs were met by the Institute (hospitality)

Director, Hildercroft Management Company Ltd (property management) (non-financial)

Fellow, Chartered Institute of Logistics and Transport (non-financial)

**Viscount Stansgate**

Informa plc (British publishing, business intelligence and exhibitions group) (shareholding)

Consultant to the American Chemical Society (ACS) (scientific society and non-profit organisation) (non-financial)

Trustee, Newton's Apple (not-for-profit charity that educates scientists about Parliament & Government) and director of the associated company (non-financial)

Trustee, Parliamentary Science and Technology Information Foundation (non-financial)

**Lord Strasburger**

Shareholder in Apple Inc (technology), Big Brother Watch Ltd (defending civil liberties), Footdown Ltd (management software)

Director, Big Brother Watch Ltd

Party to a legal challenge against the Government for alleged failure to investigate foreign state interference in the UK's democratic process, which has been crowd funded by For The Citizens Limited (a non-profit organisation)

Shareholder in Alphabet Inc, Amazon Inc, Bath & West Community Energy, LAT Water Ltd, Microsoft Inc, Tesla Inc

# Formal minutes

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**Monday 17 October 2022**

**Members present:**

Margaret Beckett MP, in the Chair

Sarah Champion MP

Tobias Ellwood MP

Baroness Anelay of St Johns

Lord Butler of Brockwell

Baroness Crawley

Lord Dannatt

Lord Reid of Cardowan

Lord Snape

Viscount Stansgate

Lord Strasburger

Draft Report, (*Readiness for storms ahead? Critical national infrastructure in an age of climate change*), proposed by the Chair, brought up and read.

*Ordered*, That the draft Report be considered, paragraph by paragraph.

Paragraphs 1 to 132 agreed to.

Summary agreed to.

*Resolved*, That the Report be the First Report of the Committee.

*Resolved*, That the Chair make the Report to the House of Commons and that the Report be made to the House of Lords.

*Ordered*, That embargoed copies of the Report be made available.

**Adjournment**

[Adjourned till 7 November at 4.00pm]

## Witnesses

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The following witnesses gave evidence. Transcripts can be viewed on the [inquiry publications page](#) of the Committee's website.

### Monday 13 December 2021

**Sir John Armitt**, Chairman, National Infrastructure Commission; **Professor Richard Dawson**, Adaptation Committee Member, Committee on Climate Change, and Director of Research & Innovation, School of Engineering, Newcastle University; **Dr Will Lang**, Head of Civil Contingencies, Met Office; **Dr Swenja Surminski**, Head of Adaptation Research, Grantham Research Institute on Climate Change and the Environment, London School of Economics (LSE)

[Q1–19](#)

### Monday 17 January 2022

**Professor Jim Hall**, Professor of Climate and Environmental Risks, University of Oxford; **John Hetherington**, Head of London Resilience; **Stuart Marshall**, Chief Emergency Planning Officer and LRF Manager, Cleveland Local Resilience Forum

[Q20–38](#)

### Monday 28 February 2022

**Steve Fletcher**, Deputy Director, Engineering and Asset Management, Office of Rail and Road; **Andria Gilmour**, Civil Engineering & External Hazards Lead Inspector, Office for Nuclear Regulation; **Emma Howard Boyd**, Chair, Environment Agency; **Dr Charlotte Ramsay**, Director, Energy Systems Management and Security, Ofgem

[Q39–47](#)

### Monday 21 March 2022

**Jim Dempsey**, Director of Service, Digital and Networks, BT Plc; **David Wright**, Chief Engineer, National Grid Group; **Martin Frobisher**, Group Safety & Engineering Director, Network Rail; **Nevil Muncaster**, Strategic Resources Director, Thames Water

[Q48–62](#)

### Monday 13 June 2022

**Professor Tim Benton**, Research Director, Emerging Risks; Director, Environment and Society Programme, Chatham House; **Professor Lenny Koh**, Cross Cutting Chief, Strategic Futures on Resource Sustainability (SCRS), University of Sheffield; **Rear Admiral (retd) Professor Neil Morisetti**, former UK Government Special Representative for Climate Change, Vice Dean (Public Policy), Faculty of Engineering Sciences, UCL

[Q63–77](#)

### Monday 18 July 2022

**Steve Double MP**, Parliamentary Under Secretary of State, Department for Environment, Food and Rural Affairs; **Greg Hands MP**, Minister of State for Business, Energy and Clean Growth, Department for Business, Energy and Industrial Strategy; **Robert Mason**, Deputy Director, Climate, Department for Environment, Food and Rural Affairs; **Mark Prouse**, Deputy Director, Energy Resilience & Emergency Response, Department for Business, Energy and Industrial Strategy; **Roger Hargreaves**, Head of the Civil Contingencies Secretariat, Cabinet Office

[Q78–101](#)

## Published written evidence

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The following written evidence was received and can be viewed on the [inquiry publications page](#) of the Committee's website.

NIC numbers are generated by the evidence processing system and so may not be complete.

- 1 Adams, Mr George (Engineer, Spie) ([NIC0004](#))
- 2 Airport Operators Association ([NIC0011](#))
- 3 Anglian Water ([NIC0029](#))
- 4 Arqiva ([NIC0028](#))
- 5 BT Plc ([NIC0045](#))
- 6 Bayfield, Mr Colin Henry (Retired, Industry Professional) ([NIC0001](#))
- 7 Blake, Laura (Chair, Thames Crossing Action Group) ([NIC0006](#))
- 8 Brown, Mr Eric (Director, Grid Scientific Limited) ([NIC0019](#))
- 9 CReDo ([NIC0030](#))
- 10 Cabinet Office ([NIC0015](#)), ([NIC0046](#))
- 11 ClimateNode ([NIC0026](#))
- 12 Cloke, Professor Hannah (Professor of Hydrology, University of Reading) ([NIC0009](#))
- 13 Department for Transport ([NIC0049](#))
- 14 Energy Networks Association ([NIC0032](#))
- 15 Environment Agency ([NIC0014](#)), ([NIC0036](#))
- 16 Hill, Dr Rowena (Associate Professor of Disasters and Emergencies, Nottingham Trent University); and Pickford, Rich (Manager of Nottingham Civic Exchange, Nottingham Trent University) ([NIC0007](#))
- 17 Institution of Engineering and Technology ([NIC0008](#))
- 18 MacAskill, Dr Kristen (Assistant Professor, University of Cambridge) ([NIC0005](#))
- 19 Met Office ([NIC0013](#))
- 20 National Grid ([NIC0042](#))
- 21 Network Rail ([NIC0012](#)), ([NIC0043](#))
- 22 Newcastle University ([NIC0040](#))
- 23 Office for Nuclear Regulation ([NIC0021](#)), ([NIC0034](#)), ([NIC0035](#))
- 24 Office of Rail and Road ([NIC0017](#)), ([NIC0037](#))
- 25 Ofgem ([NIC0016](#)), ([NIC0038](#))
- 26 Ofwat ([NIC0033](#))
- 27 Pupils 2 Parliament ([NIC0048](#))
- 28 Renukappa, Dr Suresh (Senior Lecturer, University of Wolverhampton); Seabright, Mr Luke (Researcher , University of Wolverhampton); and Suresh, Dr Subashini (Reader, University of Wolverhampton) ([NIC0020](#)), ([NIC0022](#))
- 29 Schofield, D ([NIC0041](#)), ([NIC0047](#))
- 30 Scottish Government ([NIC0018](#))
- 31 Sille Space ([NIC0023](#))

- 32 Supergen Climate Adaptation Working Group ([NIC0031](#))
- 33 techUK ([NIC0025](#))
- 34 Thames Water ([NIC0044](#))
- 35 UK Energy Research Centre ([NIC0010](#))
- 36 UK2070 Commission ([NIC0003](#))

## List of reports from the Committee during the current Parliament

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All publications from the Committee are available on the publications page of the Committee's website.

### Session 2021–22

<b>Number</b>	<b>Title</b>	<b>Reference</b>
1st	The UK's national security machinery	HC 231
1st Special	The UK's national security machinery: Government Response to the Committee's First Report	HC 947

### Session 2019–21

<b>Number</b>	<b>Title</b>	<b>Reference</b>
1st	Biosecurity and national security	HC 611
1st Special	Biosecurity and national security: Government Response to the Committee's First Report of Session 2019–21	HC 1279