



E3G

**REPORT** APRIL 2016

**FASTER, SMARTER, SAFER, CLEANER:  
MAKING BRITAIN'S INFRASTRUCTURE  
SYSTEMS FIT FOR THE FUTURE**

**NICK MABEY & TAYLOR DIMSDALE**

---

## Acknowledgements

The authors are grateful for input provided by a number of external reviewers. They would like to thank with Shin Wei Ng, Louisa Casson, Sepi Golzari-Munro, Tom Lafford and Chris Davy (E3G). The views expressed are those of the authors.

## About E3G

E3G is an independent, non-profit European organisation operating in the public interest to accelerate the global transition to sustainable development. E3G builds cross-sectoral coalitions to achieve carefully defined outcomes, chosen for their capacity to leverage change. E3G works closely with like-minded partners in government, politics, business, civil society, science, the media, public interest foundations and elsewhere. [www.e3g.org](http://www.e3g.org)

Berlin office  
Neue Promenade 6  
Berlin, 10178 – Germany  
Tel: +49 (0) 30 2887 3405

Brussels office  
Rue de la Science 23  
1040 Brussels, Belgium  
Tel: +32 (0)28 93 92 12

London office  
47 Great Guildford Street  
London SE1 0ES, UK  
Tel: +44 (0)20 7593 2020  
Fax: +44 (0)20 7633 9032

Washington DC office  
1250 24th Street NW  
Suite 300  
Washington DC, WA 20037  
United States  
Tel: +1 202 466 0573

© E3G 2016

## Copyright

This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 2.0 License.

You are free to:

Copy, distribute, display, and perform the work.

Make derivative works.

Under the following conditions:

You must attribute the work in the manner specified by the author or licensor.

You may not use this work for commercial purposes.

If you alter, transform, or build upon this work, you may distribute the resulting work only under a license identical to this one.

For any reuse or distribution, you must make clear to others the license terms of this work.

Any of these conditions can be waived if you get permission from the copyright holder.

Your fair use and other rights are in no way affected by the above.



---

**REPORT** APRIL 2016

**FASTER, SMARTER, SAFER, CLEANER:  
MAKING BRITAIN'S INFRASTRUCTURE  
SYSTEMS FIT FOR THE FUTURE**

**NICK MABEY & TAYLOR DIMSDALE**

---

# CONTENTS

<b>Acknowledgements</b> .....	2
<b>About E3G</b> .....	2
<b>Copyright</b> .....	2
<b>SUMMARY</b> .....	5
<b>RECOMMENDATIONS</b> .....	6
<b>INTRODUCTION</b> .....	10
<b>CHAPTER 1 FIVE TRENDS RESHAPING UK INFRASTRUCTURE</b> .....	11
Demographic shifts .....	11
Efficiency revolution.....	11
New digital technology .....	12
Decarbonisation.....	13
The need for resilience .....	15
<b>CHAPTER 2 CURRENT DEBATES FOCUS ON PAST CHALLENGES</b> .....	17
Misdiagnosis of the “infrastructure problem” .....	17
“Predict and provide” approaches risk misallocated investment.....	20
<b>CHAPTER 3 DEVOLVE POWERS TO DELIVER BETTER POLICIES FOR SMART, DEMAND-DRIVEN INFRASTRUCTURE INVESTMENT</b> .....	23
<b>CHAPTER 4 REFORMING THE MANAGEMENT OF UK INFRASTRUCTURE SYSTEMS</b> .....	26
<b>RECOMMENDATIONS</b> .....	28
Better management of future performance and resilience .....	28
Improving public oversight and value for money .....	29
Setting a pathway to fully devolved infrastructure .....	30
Incentivising infrastructure innovation and integration.....	30

---

## SUMMARY

### **Britain must build infrastructure systems fit for the 21<sup>st</sup> century**

The UK's "infrastructure problem" has been misdiagnosed as one of delayed, inadequate and costly infrastructure planning holding back improvements in national productivity. Long term centralised decision making is seen as the solution. But rigid, central planning risks a generation of misallocated investment and depressed economic performance. There is an alternative.

Whitehall departments struggle to accurately predict future demand. Planning to a "best guess" of future demand is doomed to failure in a future where demand and technological change will be predictably disruptive. A rigid "predict and provide" approach to individual infrastructure projects risks costly over-investment and a failure to incentivise new, cheaper solutions.

Technology, demographics and environmental constraints are reshaping what constitutes best-value infrastructure for Britain. It is no longer possible to design transport, energy, housing, water and flood protection systems in separate Whitehall silos and expect sustained economic performance. Investments in UK infrastructure need to ensure more productive, resilient and sustainable *systems* over the lifetime of the assets.

Infrastructure-UK estimated maximum cost savings of 15% from streamlining UK infrastructure processes. Far larger savings are possible from transformational shifts to smarter, more integrated infrastructure.

### **Five trends reshaping UK infrastructure needs**

#### **Demographic shifts**

The UK population is growing larger, older and more urban, transforming infrastructure demand, particularly in energy and transport;

#### **An efficiency revolution**

UK energy use in 2014 is already below its 1970 level and falling but there is still huge potential for further reductions:

- > Retrofit of UK housing stock would save consumers over £8bn per year and reduce gas demand 20% by 2030;
- > Implementing cost-effective electricity efficiency could reduce power consumption by a quarter at negative cost; avoiding the construction of 3.5 Hinkley Point nuclear stations or over 40 London Array offshore wind farms.

---

### New digital technology

Mobile technology and big data are delivering rapid and disruptive smarter infrastructure, changing how people travel and use energy and challenging assumptions about investment in transport, electricity and gas networks.

### Decarbonisation

The Paris Climate Agreement signals the commitment from developed and emerging economies to deepen global markets in clean energy and continue the dramatic price reductions seen in renewables, batteries and efficient lighting.

- > Fossil fuel use is likely to fall by 75-95% making supply infrastructure like pipelines and LNG terminals redundant.
- > Phasing out UK coal power by 2025 will free up 37% of rail freight capacity dedicated to coal transport.

### The need for resilience

Climate change impacts and growing global resource use are increasing flooding, storm and drought risks in the UK and commodity price volatility. Coupled with the decline in UK oil production this leads to increased impacts on the UK economy. However, decarbonisation will lower the economic impact of future oil price shocks by 25-60% in the next decades, improving resilience.

- > According to the Committee on Climate Change, 10-35% of infrastructure disruptions in the UK are already caused by extreme weather events
- > The number of assets in high flood risk areas will increase by at least 50% in 2050.

## RECOMMENDATIONS

### Devolution

Decisions on infrastructure investment should be shifted nearer to those who can control the level of demand. This will deliver value for money for taxpayers and consumers and ensure that investment can respond to “known unknowns”, which requires an ability to understand and manage demand, integrate across infrastructure systems, build-in flexibility and preserve optionality.

Though devolution should not be seen as a panacea, it is a necessary component of delivering modern infrastructure systems. Taking advantage of digital smart technologies and the opportunities of convergence of infrastructure systems requires careful integration at the local level of consumer markets, supply chains, physical systems and planning choices. In many cases, the local level will be the optimal place to manage infrastructure as this is where demand for services, infrastructure systems and use of public finance can be combined.

---

The current English City devolution process is an opportunity to empower local authorities to deliver smart infrastructure projects but current proposals are much less ambitious than the infrastructure devolution settlement to the Scottish and Welsh Administrations. Central government can help English cities overcome the “Catch 22” situation in which a perceived lack of capacity is the main argument against devolving new powers. Government should:

**1. Deliver full infrastructure devolution**

Set a firm pathway for full devolution of infrastructure powers to English Cities and regions by 2025 which gives parity with powers devolved to Scotland and Wales. The National Infrastructure Commission should provide recommendations in 2016 on a pathway to devolve powers in England including how to improve city delivery capacity and ensure consistency between the different levels of infrastructure management.

**2. Drive regulatory and market innovation through smart infrastructure zones**

Develop new models for integrated and smart infrastructure by front-loading the devolution process through a competitive bid process for 2-3 city regions to become “smart infrastructure zones”. These would cover up to 30% of city GDP with cities supported to pioneer new approaches through regulatory or other incentives.

The National Infrastructure Commission should develop a clear process for implementing such zones in its 2016 workplan. Increased support should also come from the Green Investment Bank and Infrastructure Projects Authority.

**3. Broaden the scope of existing Core City devolution packages**

Alongside devolution of transport spending the government should include domestic energy efficiency retrofitting and low carbon heating/cooling as part of the core devolution package in the current round of devolution to Core Cities. These areas should be prioritised in UK projects proposed for the European Fund for Strategic Investment.

**4. Give citizens more control over infrastructure choices**

As part of the devolution process local governments should be given more democratic control to raise local standards of air quality, fuel poverty, energy security, transport safety, noise, and extreme weather resilience.

---

## Reforming the management of UK infrastructure systems

The UK must avoid a false choice between driving quality, quantity and resilience in its infrastructure systems. Delivering world-class performance on all objectives requires significant governance reforms.

### 5. Define infrastructure

The working definition of infrastructure should be expanded to explicitly include new housing/buildings, energy efficiency in existing buildings, distributed energy systems, electrical efficiency and – based on advice from the Natural Capital Committee – include “green” infrastructure such as forests and natural flood defences. This will ensure that all options are fairly assessed for best value.

### 6. Collaborate on integrated demand and risk scenarios

To improve management of performance and resilience the Committee on Climate Change, National Infrastructure Commission, Economic Regulators Network, National Audit Office and Natural Capital Committee should collaborate every 5 years to produce consistent forward demand and risk scenarios for the UK covering all major infrastructure systems and their interactions. All UK regulators and decision makers should be required to take account of these scenarios in their work and justify deviations. The aim must not be to try to predict the future but to ensure that the impact of predictable trends is not being wilfully ignored in order to simplify decision making.

### 7. Establish a National Resilience Office

The Cabinet Office should expand its role from emergency planning to oversee performance and resilience in investment plans and decisions. Clear responsibility for UK infrastructure resilience, including economic resilience, should be given to a new National Security Council ministerial sub-committee supported by a National Resilience Office (NRO) built on the relevant existing Cabinet Office units.

### 8. Create a requirement for strategic risk management

Departments (and in due course cities and regions) should demonstrate to the NRO that they have adequate strategic risk management processes to ensure existing and planned infrastructure portfolios will deliver value for money and resilience against the full range of UK demand, supply and risk scenarios. The operation of strategic risk management systems should become a key indicator in departmental management performance.

### 9. Conduct a post-Paris climate risk assessment

The government should undertake a review of the changes to management of energy security and climate impact risks in light of the Paris Climate Change Agreement. The NRO should take responsibility for coordinating the statutory Climate Change Risk Assessment report to Parliament in January 2017.

---

## **Improving public oversight and value for money**

The UK infrastructure system lacks public trust. Surveys suggest the public would prefer more investment in areas like energy efficiency and less on flagship projects such as HS2. Alignment with public priorities could be improved with stronger Parliamentary oversight and more transparency over public value cases.

### **10. Create a parliamentary Joint Committee on Infrastructure**

Establish a parliamentary Joint Committee on Infrastructure – analogous to the Joint Committee on the National Security Strategy – with a dedicated chair and members made up of the chairs of the relevant departmental select committees. The Parliamentary Committee would have the power to call the Prime Minister, Chancellor of the Exchequer and Departmental Heads to give evidence on the value and impact of UK infrastructure spend.

### **11. Conduct a zero-base review of the UK infrastructure portfolio**

Based on the first set of five-yearly scenarios the NAO should work with the National Infrastructure Committee and government departments to undertake a zero-base value for money review of the UK infrastructure portfolio. The review would report jointly to the Government and the Joint Parliamentary Committee on Infrastructure in 2017.

### **12. Improve transparency of spending and business cases**

In line with government policy on transparency all infrastructure business cases should be made public from the point the Strategic Outline Business case is submitted by departments or local authorities. A policy should be adopted that only minimal redactions be made for exceptional cases of commercial confidentiality.

## **Incentivising infrastructure innovation and integration**

### **13. Establish an infrastructure innovation fund**

Increase incentives for innovative and integrated infrastructure by setting aside 15% of annual public infrastructure spending for highly innovative projects and programmes involving cooperation between multiple departments, local administrations or regulatory authorities.

### **14. Reform public procurement incentives for innovative resource efficient and low carbon infrastructure**

Reform performance guidelines for all public and public-private infrastructure procurement which incentivise higher resource efficiency and lower embedded carbon in construction; for example, using a shadow carbon price on embedded carbon and preferences for use of recycled resources.

---

## INTRODUCTION

In order to build a competitive, productive, resilient and sustainable economy, the UK must deliver around £750bn in new infrastructure and supply chain investment by 2025, which must be compatible with a low carbon economy and climate change<sup>1</sup>. This is a daunting challenge at a time of fiscal austerity and shrinking public budgets.

Too often the debate over infrastructure is focused on the quantity of investment needed and barriers to rapid construction, rather than on the quality and value of the infrastructure being built. The World Economic Forum ranks the UK just 24<sup>th</sup> in the world in overall quality of its infrastructure<sup>2</sup>. The UK cannot afford to build the infrastructure of the past, only slightly cheaper and faster, at a time when global and national forces are reshaping the landscape of what constitutes the best-value infrastructure for Britain.

These trends are often seen as risks and uncertainties but moving towards a smart, low carbon and decentralised infrastructure policy in the UK brings potential for significant export opportunities for UK businesses. Global infrastructure investment is estimated at \$90 trillion to 2030. Nearly 80% of this will be in emerging economies that need external expertise to deliver the shift to efficient, resilient and clean infrastructure<sup>3</sup>. The UK has many world-leading firms in the integrated infrastructure sector which could benefit from a stronger home market.

The UK cannot compete by trying to build conventional infrastructure as quickly as China but it can be a global leader at building the smarter and cleaner infrastructure that emerging economies need.

---

<sup>1</sup> E3G, 2010, **Accelerating the Transition to a Low-carbon Economy**

<sup>2</sup> World Economic Forum, 2015, **Global Competitiveness Report 2015-2016**

<sup>3</sup> The New Climate Economy, 2014, **Better Growth, Better Climate**

---

# CHAPTER 1

## FIVE TRENDS RESHAPING UK INFRASTRUCTURE

Demographic shifts, an efficiency revolution, new digital technology, decarbonisation and the need for resilience against the changing climate and global resource pressures are radically altering the future context for UK infrastructure.

### Demographic shifts

Demographic shifts are changing the profile of infrastructure demand in cities, particularly in energy and transport.

The UK population is becoming larger, older and more urban. Projections show population growth from today's 64 million to well over 70 million by 2030<sup>4</sup>. This will mostly be concentrated in the Southern parts of England; other areas will see absolute decreases in population although this may change as housing pressures intensify.

There will be a large increase in the population over 70 as the baby boom generations of the 1940s and 1960s age<sup>5</sup>. These affluent, retired but active groups are likely to have very different consumption behaviour than previous generations. These qualitative changes undermine the utility of quantitative forecasts based on past behaviour.

These shifts are already changing the profile of infrastructure demand. Despite the fast growing population, government forecasts for the absolute amount of car travel have been consistently revised downwards over the past 25 years, and actual miles driven have remained static since 2000. Car driving and ownership among young people is at historic lows as they move into city centres to study and remain to work<sup>6</sup>.

### Efficiency revolution

In 2014 UK energy use fell below its 1970's level despite real economic growth of 200% and higher manufacturing output<sup>7</sup>. Solid fuels and gas consumption have declined whereas the use of renewables in electricity generation is rising and now accounts for almost one quarter of generation<sup>8</sup>.

---

<sup>4</sup> Office for National Statistics, 2015, **National Population Projections: 2014-Based Statistical Bulletin**

<sup>5</sup> Ibid.

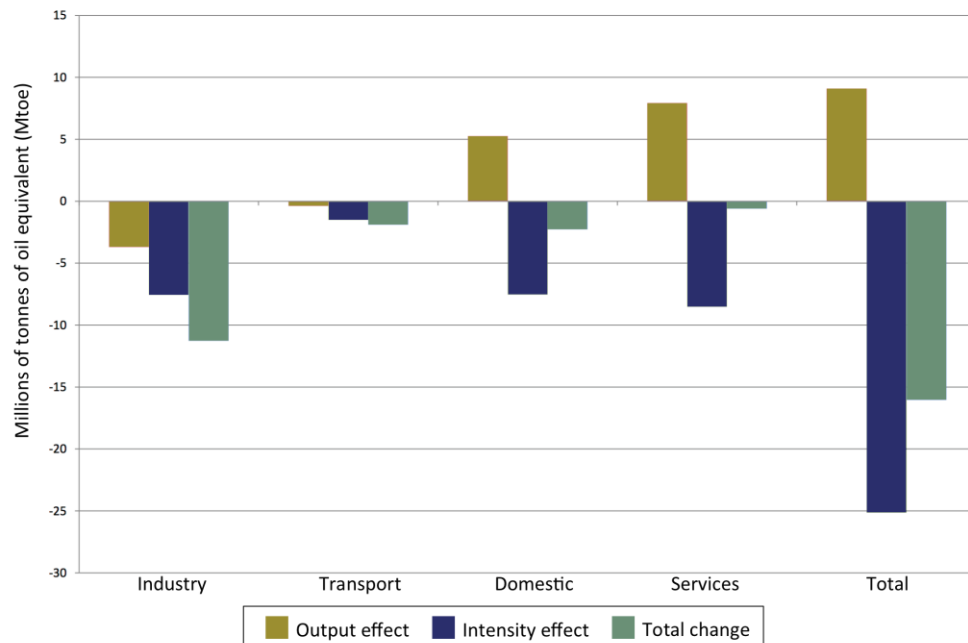
<sup>6</sup> DECC, 2015, **Driving licence holding and vehicle availability (NTS02)**; and CTC, 2012 "Young People are Driving Less"

<sup>7</sup> DECC, 2015, **Energy Consumption in the UK, Chapter 1 (2015)**

<sup>8</sup> DECC, 2015, **UK Renewables Statistics (Q3 2015)**

Energy efficiency is the main driver of these changes across all sectors of the UK economy in the last decade rather than price rises, shifts in economic structure or decline in manufacturing, as seen in Figure 1<sup>9</sup>.

Figure 1: Factors affecting UK Final Energy Consumption 2000-2013 (Source: DECC 2015)



The cost of ultra-efficient LED light bulbs alone has fallen by 84% in the last 5 years<sup>10</sup>. Global investment in efficiency is now larger than new investment in supply side power production<sup>11</sup>. Improvements in efficiency are likely to accelerate in the coming decades as costs of energy efficient equipment continue to fall due to growing markets.

Delivering cost-effective retrofit of the UK housing stock would save consumers over £8bn per year in energy bills and reduce UK gas demand by 20% by 2030<sup>12</sup>. It would also ensure that the UK's world-leading energy efficiency firms benefit from a stronger home market.

### New digital technology

System innovation driven by mobile technology, big data and clean tech is creating smarter infrastructure in cities across the world<sup>13</sup>. Dynamic management of traffic flows is improving efficiency of road and bus use. Services like Uber and ZipCar are

<sup>9</sup> DECC, 2015, **Energy Consumption in the UK, Chapter 1 (2015)**

<sup>10</sup> US Department of Energy, 2014, **Solid State Lighting Research and Development Multi-Year Program Plan**

<sup>11</sup> OECD/IEA, 2014, **Energy Efficiency Market Report**

<sup>12</sup> Energy Bill Revolution/E3G, 2014, **Building the Future: The Economic and Fiscal Impacts of Making Homes Energy Efficient**

<sup>13</sup> BIS, 2013, **The Smart City Market: Opportunities for the UK**

---

changing travel and vehicle use patterns. Smart phones allow productive working on public transport and are reducing the “value of time” saved through transport investment and the attractiveness of car travel.

The UK is undertaking a major programme of installing smart metering in all households that will enable a radical shift in how the power grid is managed<sup>14</sup>. Smarter electricity grids and distributed smart devices allow consumers to automatically respond to energy price signals, reducing the cost of maintaining back-up generation and grid capacity. Devices such as Google’s NEST and British Gas’s HIVE allow consumers to optimise heating consumption. The impact of these devices will increase as the “internet of things” becomes a reality and electrical appliances become networked. The rapid penetration of solar technology, distributed storage and local micro-grids will empower consumers, lower costs, improve security of supply and could reduce investment in expensive electricity and gas networks.

Deployment of these innovations is accelerating as new forms of electricity market governance are pioneered across the world, led by sub-national jurisdictions such as New York<sup>15</sup>. UK regulators are currently reviewing how domestic markets can incentivise the emergence of new business models and technologies, and the EU Energy Union will publish proposed EU wide reforms in these areas in 2016.

## Decarbonisation

To meet its legal commitment to decarbonise the energy system by mid-century, the UK must reduce emissions from infrastructure. By 2025 infrastructure will be directly responsible for over 80% of CO2 emissions, up from just over 50% in 2010<sup>16</sup>. Adopting best practice in infrastructure carbon reduction would represent a net benefit to the UK economy of £1.46bn per year according to the UK Treasury<sup>17</sup>.

Under future technology scenarios, UK fossil fuel use falls dramatically by 75-95% in the next three decades<sup>18</sup>. This transition is driving fundamental changes to the fuel supply infrastructure of gas pipelines and coal handling, increasing the risks of fossil asset stranding as projected demand fails to materialise. This risk is already present in the European gas system where demand is 23% below its peak<sup>19</sup>. UK and EU LNG terminals are operating well below capacity, with EU utilisation under 25%<sup>20</sup>. The consequences extend beyond the energy sector. For example, 37% of UK railway freight traffic supplies coal to power stations<sup>21</sup>. The government announcement to phase out coal by 2025 will liberate this capacity for other economic uses.

The 2020s will see the continuing convergence of investment in building efficiency, electricity and gas infrastructure, and the beginning of the integration of electricity

---

<sup>14</sup> House of Commons Energy and Climate Change Committee, 2014, **Progress on Smart Meter Roll-out**

<sup>15</sup> See: New York’s **Reforming the Energy Vision**

<sup>16</sup> HMT, 2013, **Infrastructure Carbon Review**

<sup>17</sup> Ibid

<sup>18</sup> Ibid

<sup>19</sup> E3G, 2015, **Europe’s Declining Gas Demand: Implications for Infrastructure Investment and Energy Security**

<sup>20</sup> E3G, 2015, **What Gas Strategy for a European Energy System in Transition? Investment Choices Under Uncertainty**

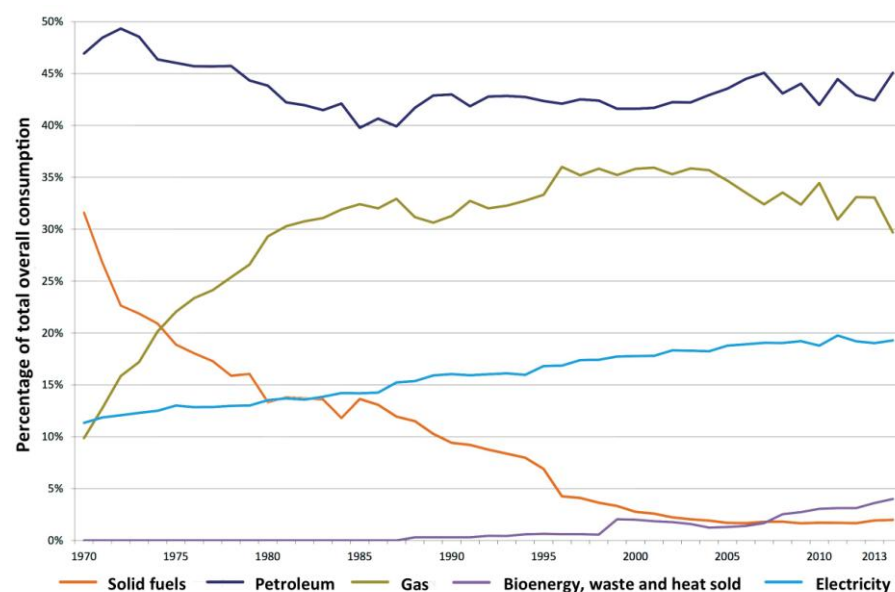
<sup>21</sup> Office of Rail Regulation, 2014, **Freight Rail Usage: 2014-15 Q1 Statistical Release**

and transport systems. Electricity consumption is falling as goods like computers and fridges become more efficient due to advancing technology and European product regulation. However, this trend may reverse with demand doubling by 2040 following large scale electrification of transport and heating<sup>22</sup>.

It will be impossible to make a credible case for future energy investment without a clear assessment of the impact of regulation and public investment on future demand. This must include assessment of international power resources as the UK grid will be increasingly balanced at European scale, drawing on Norwegian hydroelectric, Irish wind and Spanish solar power<sup>23</sup>.

Falling technology costs also mean that solar power will account for a large share of future energy supply globally. The levelised cost of solar PV has fallen by 78% since 2009 and is increasingly cost competitive with fossil fuels<sup>24</sup>. Solar generation in the UK has grown from under 1GW in 2010 to almost 9GW by the end of Q3 2015<sup>25</sup>. This was largely unanticipated. In 2011 the Committee on Climate Change expected negligible amounts of solar power in the UK by 2030<sup>26</sup>. Falling costs for distributed generation will be reinforced by the proliferation of newly available battery storage systems for homes and large-scale commercial business, such as the Tesla Powerwall.

Figure 2. Final energy consumption by fuel, UK (1970-2014) (Source: DECC 2014)



In the medium term the UK needs to reduce carbon emissions produced when constructing infrastructure – so-called “embodied” or “construction” carbon – to meet its statutory targets. Without technological improvement, embodied carbon in

<sup>22</sup> HMG, 2010, **2050 Pathways Analysis**

<sup>23</sup> Ibid

<sup>24</sup> Lazard, 2014, **Lazard’s Levelized Cost of Energy Analysis – Version 8**

<sup>25</sup> DECC, 2015, **UK Renewables Statistics (Q3 2015)**

<sup>26</sup> Committee on Climate Change, 2011, **Meeting Carbon Budget – 3<sup>rd</sup> Progress Report to Parliament**

---

the steel, cement and chemicals used to build infrastructure will be 18% of UK annual emissions in 2050<sup>27</sup>. There are many ways of reducing embodied carbon such as carbon capture and storage on process emissions, designing out materials or substitution with lower carbon alternatives. The UK Government has developed outline plans to decarbonise some of these high polluting sectors<sup>28</sup>. However, infrastructure procurement currently provides no incentives for the use of low-embodied carbon options so these alternatives remain in labs or stuck at the demonstration stage. With global markets in low carbon construction likely to expand quickly in the coming decade, innovation incentives could secure domestic production and lay the foundation for profitable UK export industries.

### The need for resilience

Climate change is sharply increasing flooding, storm and drought risks in the UK<sup>29</sup>. According to the Committee on Climate Change, 10-35% of infrastructure disruptions in the UK are already caused by extreme weather events<sup>30</sup>. Two million people lost power in the 2013/14 floods, and power outages disrupted trade through Gatwick and three major ports. The number of assets in high flood risk areas will increase by at least 50% in 2050<sup>31</sup>. Under current climate trends the “500 year” heatwave in 2003, which buckled railway tracks and caused drought restrictions, will likely happen every other year by 2050<sup>32</sup>. Given its integration into the global economy the UK will be heavily impacted by climate disruption to global supply chains, such as those caused by the Thailand floods in 2011<sup>33</sup>.

Superstorm Sandy showed that the greatest impacts of extreme weather come from cascading failures across water, power, telecoms and transport networks. In New York, power outages led to failures in other infrastructures such as rail lines, wireless and Internet, and refineries, ultimately costing over \$50bn in damage. The government recognises that more integrated infrastructure planning is needed to ensure the UK maintains essential resilience but is yet to move beyond early research in this area<sup>34</sup>.

A changing climate intensifies already rising resource pressures. Water availability could become a major economic constraint without demand management. Large scale investment to meet this challenge is risky because projections of household water use in 2050 differ by 100% across scenarios, and projections of future seasonal

---

<sup>27</sup> HMT, 2013, **UK Infrastructure Carbon Review**

<sup>28</sup> DECC/BIS, 2015, **Industrial Decarbonisation and Energy Efficiency Roadmaps to 2050**

<sup>29</sup> Ofwat, 2010, **Changes in the Frequency of Extreme Rainfall Events for Selected Towns and Cities**

<sup>30</sup> Committee on Climate Change, 2015, **Progress in Preparing for Climate Change: 2015 Report to Parliament**

<sup>31</sup> Ibid

<sup>32</sup> Met Office, **Learning About the Weather: The Heatwave of 2003**

<sup>33</sup> International Journal of Disaster Risk Reduction, 2014, Haraguchi M, Lall U. **Flood Risks and Impacts: A Case Study of Thailand's Floods in 2011 and Research Questions for Supply Chain Decision Making**; and

PWC, 2013 **International Threats and Opportunities of Climate Change for the UK**

<sup>34</sup> International Centre for Infrastructure Futures, 2014, **Adaptation and Resilience of Interdependent Infrastructure Systems: A Complex Systems Perspective**

---

rainfall levels differ by over 50% depending on global greenhouse gas emission scenarios<sup>35</sup>.

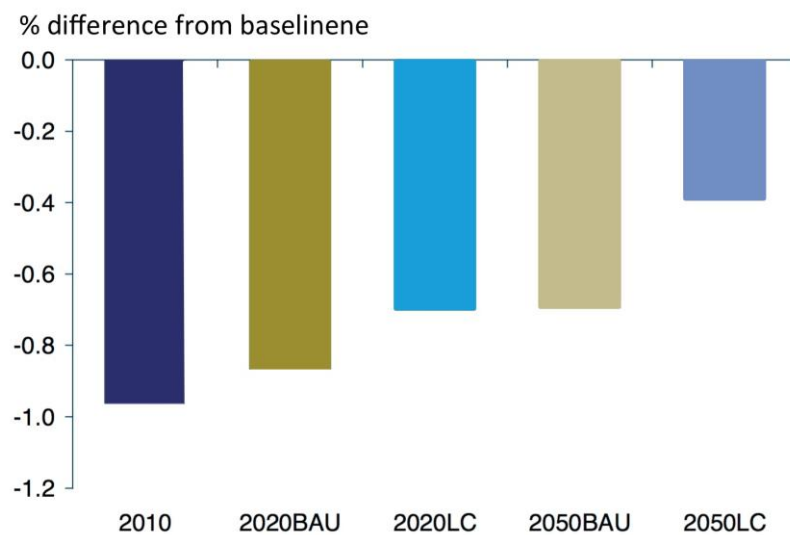
Growing global resource use is already increasing price volatility and supply constraints on a range of vital commodities, not just oil<sup>36</sup>. As the UK becomes a growing net importer of oil and gas the economic impact of oil prices will steadily increase on macroeconomic growth and trade balances<sup>37</sup>.

These trends are adding to uncertainty concerning what infrastructure investment will best support UK security and prosperity into the future. There is an urgent need to begin systematically assessing economic resilience in preparation for a range of future scenarios. For example, as Figure 3 shows, DECC modelling estimates that the impact on the UK from fossil price shocks could be reduced by up to 25% in 2020 and 40% in 2050 through the introduction of planned climate change policies<sup>38</sup>.

Beyond the economics of individual projects these trends will drive a more integrated set of infrastructure systems and services markets, with greater cross-interdependencies and shared digital control networks.

Attempting to meet these challenges – and related opportunities – through a rigid “predict and provide” approach to individual infrastructure systems risks costly investment in vulnerable, low productivity infrastructure unable to take advantage of new technologies.

*Figure 3. Impact on GDP of a commodity price shock (“2050LC” is the low carbon scenario) (Source: Oxford Economics)*



---

<sup>35</sup> Technology Strategy Board, 2010, **Design for Future Climate: Opportunities for Adaptation in the Built Environment**, Appendix 1

<sup>36</sup> Chatham House, 2012, **Resources Futures**

<sup>37</sup> Office of Budget Responsibility, 2010, **Assessment of the Impact of Oil Price Fluctuations on the Public Finances**

<sup>38</sup> DECC, 2011, **Fossil Fuel Price Shocks and a Low Carbon Economy**

---

## CHAPTER 2

# CURRENT DEBATES FOCUS ON PAST CHALLENGES

The UK's "infrastructure problem" has been misdiagnosed as one of delayed, inadequate and costly infrastructure planning. Long term centralised decision making is seen as the solution but this supply side diagnosis lacks evidence. Technology, demographics and environmental constraints are reshaping what constitutes best-value infrastructure for Britain. A transformational shift to smarter, more integrated and distributed infrastructure is needed.

### **Misdiagnosis of the "infrastructure problem"**

The 2016 National Infrastructure Pipeline remains biased towards centralised, supply side and high carbon projects. Funding for energy projects remains strongly directed toward fossil fuel projects, which account for £55bn or 41% of total energy infrastructure spending.

In contrast to the 2014 infrastructure pipeline, the 2016 plan shows that private sector interest in high carbon infrastructure is declining, with investment expected to half by 2020. Unfortunately public sector investment is forecast to increase from £4.8bn in 2015 to £6.4bn by 2020<sup>39</sup>. Little attention has been given to reducing demand and improving efficiency. The plan also largely ignores ecosystem management approaches which are often far more cost effective than traditional infrastructure projects (*see Box 1*).

Recent reforms to national infrastructure planning and financing processes, including in the 2015 Infrastructure Bill, frame the UK's problem as one of delayed, inadequate and costly infrastructure planning that is holding back improvements in national productivity. A lack of long term centralised decision making is seen as the key issue.

Government responses have focused on decreasing planning delays, improving public sector project management by merging Infrastructure-UK with the Major Projects Authority to create the Infrastructure and Projects Authority, and attempting to increase finance flows to large scale infrastructure through initiatives such as the Pensions Platform and UK Guarantees Scheme.

In 2014 the Labour Party proposed removing political decision making from the infrastructure process. The recommendations of the Armitt Review to establish an

---

<sup>39</sup> Green Alliance, 2016, *Is 2015 the turning point for low carbon investment in the UK?*

---

independent National Infrastructure Commission and a 30 year National Infrastructure Assessment were supported by many business groups such as the CBI, EFF and IoD<sup>40</sup>. The recent announcement by the Conservative government of its own National Infrastructure Commission (NIC) seems to follow a similar rationale, though the precise scope and focus of the NIC is in development over the course of 2016.

This “supply side” diagnosis of problems with UK infrastructure is poorly supported by the evidence and ignores forward trends shaping infrastructure productivity and resilience. In contrast to this elite perception that UK infrastructure is in “crisis”, a survey of public attitudes reports that only 27% of respondents are dissatisfied with either local or national infrastructure<sup>41</sup>. The same survey suggests that the public is prepared to accept delays in infrastructure delivery if that provides more time for public scrutiny.

Infrastructure-UK estimated that cost savings of up to 15% were possible from maximising the streamlining of UK infrastructure processes<sup>42</sup>. However, far larger savings would result from a transformational shift to smarter, more integrated and distributed infrastructure.

Building smarter electricity grids would be significantly cheaper than conventional grid investments, delivering cost savings of as much as £19 billion to 2050<sup>43</sup>.

Implementing cost-effective electricity efficiency technologies could reduce power consumption by 25% at negative cost; avoiding investment in heavily supported supply side options equivalent to 3.5 Hinkley Point nuclear stations or over 40 London Array offshore wind farms<sup>44</sup>.

Returns on investment on a large selection of UK natural capital solutions are estimated to match those in physical infrastructure but have lower cost and delivery risks<sup>45</sup>. Fundamentally new approaches using “green” natural solutions to water and flooding problems demonstrate savings over 60%<sup>46</sup>. However, current systems in the UK provide limited incentives for innovative approaches. Councils have few incentives to collectively improve local resilience by “building back better” after flood events as flood damages in high risk areas are “socialised” through cross-subsidy surcharge across all home owners through the Flood Re scheme<sup>47</sup>.

One reason for different diagnoses of the UK national infrastructure problem is that debates are too often distorted by a focus on transport spending. Transport makes up 32% of the national infrastructure pipeline, but receives 88% of direct public spending

---

<sup>40</sup> Labour’s Policy Review, 2013, **The Armit Review**

<sup>41</sup> CBI, 2015, **Infrastructure: What the UK Public Thinks**

<sup>42</sup> HMT, 2014, **Infrastructure Cost Review: Measuring and Improving Delivery**

<sup>43</sup> EY, 2012, **Great Britain: Unlocking the Potential of Smart Grid**

<sup>44</sup> E3G calculations based on estimates of cost effective electricity demand reduction potential in:

DECC, 2012, **Capturing the Full Electricity Efficiency Potential of the UK**

<sup>45</sup> Natural Capital Committee, 2013, **First State of Natural Capital**

<sup>46</sup> US Environmental Protection Agency, 2015, **Cost Benefit Analyses of Green Infrastructure**

<sup>47</sup> Association of British Insurers, **Flood Re: A Customer Guide**

---

on infrastructure<sup>48</sup>. In contrast, most other infrastructure is paid for by consumers under a regulated rate of return or contract model and so depends on policy and regulatory decisions to determine what infrastructure is built.

### Box 1: Integrating Ecosystem Management into Infrastructure Planning

Natural ecosystems have a critical role to play in increasing resilience to climate change. Also called green infrastructure or ecosystem-based adaptation<sup>49</sup> this refers to the farmland, woodland, wetlands or other natural ecosystems that provide services like flood protection, carbon storage or water purification. Importantly ecosystem management is an option that is often more readily available to the most vulnerable communities and the rural poor.

Evidence suggests that investments in ecosystems, or “natural capital”, are competitive with the returns generated by more traditional heavy infrastructure or technological investments that are made to reduce vulnerability to extreme weather events or other natural disasters<sup>50</sup>. The UK National Ecosystem Assessment (NEA) for example placed the value of coastal wetlands at £1.5 billion annually in terms of the role they play in buffering the effects of storms and in controlling flooding<sup>51</sup>. The Economics of Ecosystems and Biodiversity (TEEB) study showed that loss of land-based ecosystems has already cost around €500 billion over the last ten years globally.

Ecosystems have an important relationship with climate change. They can manage increased flood risk and regulate water flow, and can also act as climate regulators through local cooling and carbon capture by trees and management of areas of high carbon stock, such as peatland. Coastal habitats such as mangroves can guard against storm-surges. Sustainable management of grasslands and rangelands can increase resilience to drought and flooding<sup>52</sup>. On the other hand, poorly designed engineered solutions can have significant negative impacts to natural systems<sup>53</sup>.

The UK National Ecosystem Assessment (UK NEA) in 2011 was the first analysis of the UK’s natural environment in terms of the benefits it provides to society and the economy. The NEA found that over 30% of the services provided by the natural environment in the UK are in decline. It argued that the economic and social benefits of the natural environment are not properly valued and

---

<sup>48</sup> HMT, 2016, **National Infrastructure Pipeline**

<sup>49</sup> The use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people and communities adapt to the negative effects of climate change at local, national, regional and global levels.

<sup>50</sup> Costanza et al., 2008, **The Value of Coastal Wetlands for Hurricane Protection**; and The World Bank, 2009, **Convenient Solutions to an Inconvenient Truth: Ecosystem Based Approaches to Climate Change**

<sup>51</sup> NEA, 2011, **UK National Ecosystem Assessment**

<sup>52</sup> International Union for Conservation of Nature, 2009, **Eco-system Based Adaptation: A Natural Response to Climate Change**

<sup>53</sup> UNEP, **Building Resilience of Ecosystems for Adaptation**

---

insufficient money is being allocated to improving natural capital infrastructure in the UK.

In 2011 after the first NEA the UK Government released a White Paper entitled “Natural Environment – The Natural Choice: Securing the Value of Nature”. The White Paper set a goal for this to be the first generation to leave the natural environment of England in a better state than it inherited. It called for the establishment of a Green Infrastructure Partnership with civil society to support the development of green infrastructure in England.

The 2011 White Paper also resulted in the formation of the Natural Capital Committee (NCC)<sup>54</sup>. The NCC called for the Government to develop a strategy and corresponding 25-year plan. Amongst the recommendations made by the NCC is a call to integrate an investment programme for natural capital into the National Infrastructure Plan, and to identify priority investments to incorporate into the NIP:

*“The National Infrastructure Plan should incorporate natural capital into each of the main infrastructure sectors, following the mitigation hierarchy for managing impacts (avoid, minimise, restore, offset). An investment programme for natural capital should also explicitly feature in the National Infrastructure Plan.”*

The UK has made important progress in improving the management of ecosystem services. A recent good practice review of 101 Ecosystem-Based Adaptation (EBA) projects across 17 European countries found that roughly half were based in the UK. The study found that EBA approaches yield a number of environmental, social and economic benefits in addition to adaptation or mitigation, and that success involved two key elements: stakeholder engagement and communication, and monitoring and adaptive management<sup>55</sup>.

### **“Predict and provide” approaches risk misallocated investment**

Defining the “answer” to the UK’s infrastructure problem as the need for more central control risks a generation of misallocated investment. UK central planners consistently struggle to accurately predict future demand. Road transport was 50% lower in 2010 than DfT predicted in 1990. Forecasts of congestion growth on the national strategic road infrastructure have large ranges: 6% to 26% for 2020 and 22% to 67% for 2030<sup>56</sup>. This analysis does not take into account demographic changes and the impact of information technology on transport demand by 2030. Planning road investment against such ranges makes cost-benefit analysis practically meaningless as a project selection tool.

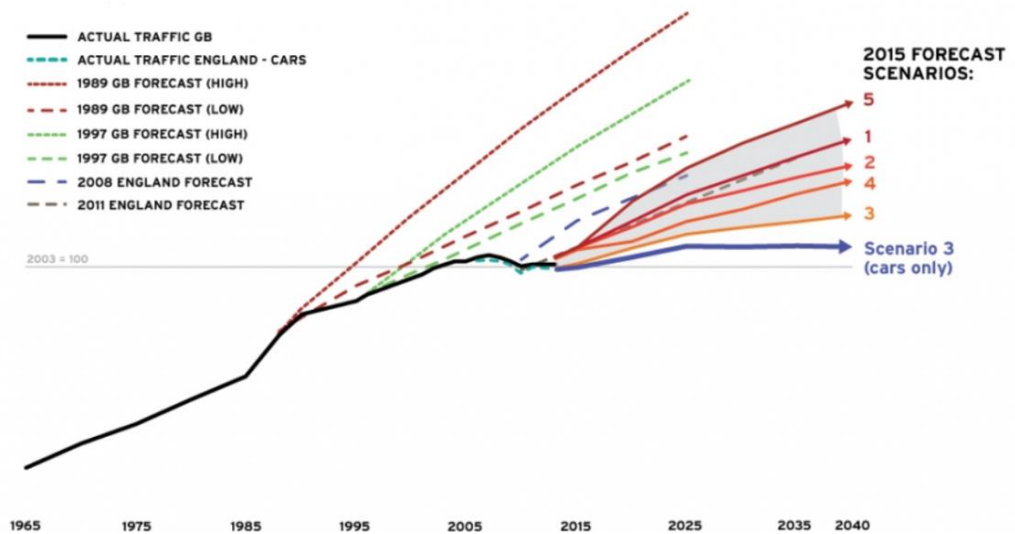
---

<sup>54</sup> <http://www.naturalcapitalcommittee.org/>

<sup>55</sup> Doswald and Osti, 2011, *Ecosystem-based Approaches to Adaptation and Mitigation – Good Practice Examples and Lessons Learned in Europe*

<sup>56</sup> DfT, 2013, *Draft National Policy Statement for National Networks*

Figure 4. DfT Forecasts versus Actual Car Traffic Growth (Source: Campaign for Better Transport, 2015)<sup>57</sup>



Estimates of city congestion are even more variable. Congestion costs in London are predicted to increase 80% by 2030 although vehicle registrations in Greater London have fallen by over 1 million in the last decade<sup>58</sup>. If this projected congestion emerges it would cost London over \$200bn, which justifies major public transport infrastructure investment to provide relief. There are clear benefits to co-designing demand and supply together at city level alongside use of smart transport systems. Given that congestion will be driven by London’s population and GDP growth, not increased travel per person, there is an opportunity to “design out demand” through planning decisions over the location of new housing and workplace developments.

Smart transport options are growing rapidly, bolstered by a global market expected to reach over \$100bn a year in 2020<sup>59</sup>. By improving smart systems, cities can make public transport and ride sharing options more attractive, reducing congestion at very low cost. Government studies show that the UK is behind in deploying these solutions despite having high costs of congestion compared to other developed countries.

Well-founded ranges of uncertainty should not be ignored in order to make the case for new investment. Decision makers need to factor in the potential for stranded assets or they risk wasting consumers’ and taxpayers’ money. Such risk management may involve a fundamental switch in investment strategy. For example, as seen in Figure 5, forecasts for gas prices in Britain in 2030 range between 60–140 pence per therm. There is no dominant low carbon supply side generation technology across this whole range given uncertainties over the cost of carbon capture and storage. However, large scale investments in electricity demand reduction will be reliably cost-effective at all these prices. A shift to a demand side investment strategy would

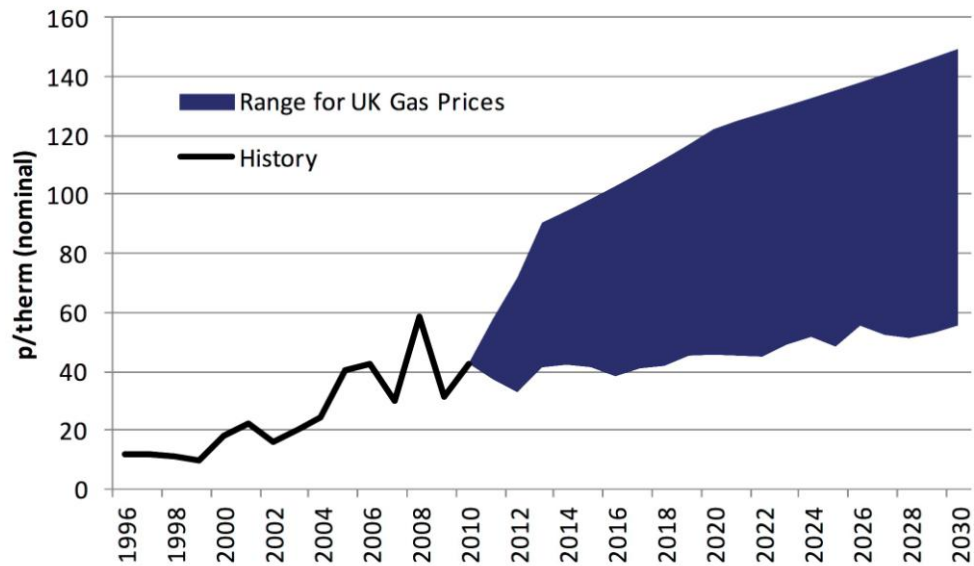
<sup>57</sup> Campaign for Better Transport, 2015, **Government Traffic Forecasts 2015**

<sup>58</sup> Centre for Economics and Business Research, 2014, **The future economic and environmental costs of gridlock in 2030**

<sup>59</sup> BIS, 2013, **The Smart City Market: Opportunities for the UK**

therefore have the dual benefits of lowering costs and delaying expensive long term supply side decisions until technology costs are better understood<sup>60</sup>.

Figure 5: UK Gas Price Projections (Source: DECC, National Grid, Poyry)<sup>61</sup>



<sup>60</sup> E3G, 2012, *Risk Managing Power Sector Decarbonisation in the UK, Briefing Paper*

<sup>61</sup> Navigant, 2013, *Unconventional Gas: The Potential Impact on UK Gas Prices*

---

## CHAPTER 3

# DEVOLVE POWERS TO DELIVER BETTER POLICIES FOR SMART, DEMAND-DRIVEN INFRASTRUCTURE INVESTMENT

Ensuring that taxpayers get value for their money will require that decisions on certain types of strategic infrastructure investments are shifted nearer to those who can control the level of demand.

Responding to predictable future uncertainties – or “known unknowns” – requires an ability to understand and manage demand, integrate across infrastructure systems, build-in flexibility and preserve optionality. Taking advantage of digital smart technologies and the opportunities of convergence of infrastructure systems requires careful integration at the local level of consumer markets, physical systems and planning choices. Pioneering approaches to managing integrated infrastructure can be seen in New York and Berlin in electricity systems, in Singapore on water use and to an extent in London on managing climate adaptation.

Though devolution should not be seen as a panacea, it is a necessary component of delivering modern infrastructure. Comparisons with more federal countries such as Germany and the US show that the current system of centralised decision-making is resulting in the UK falling behind in delivering sophisticated, responsive and integrated systems<sup>62</sup>. Even improved national-level coordination between Whitehall and the economic regulators would fail to unblock the UK’s ability to deploy smart infrastructure.

In many cases, this can only be done at the local level where demand for services, infrastructure systems and use of public finance can be combined. However, most local governments lack the capacity and resources required for adequate needs assessment and funding priorities for smart infrastructure projects.

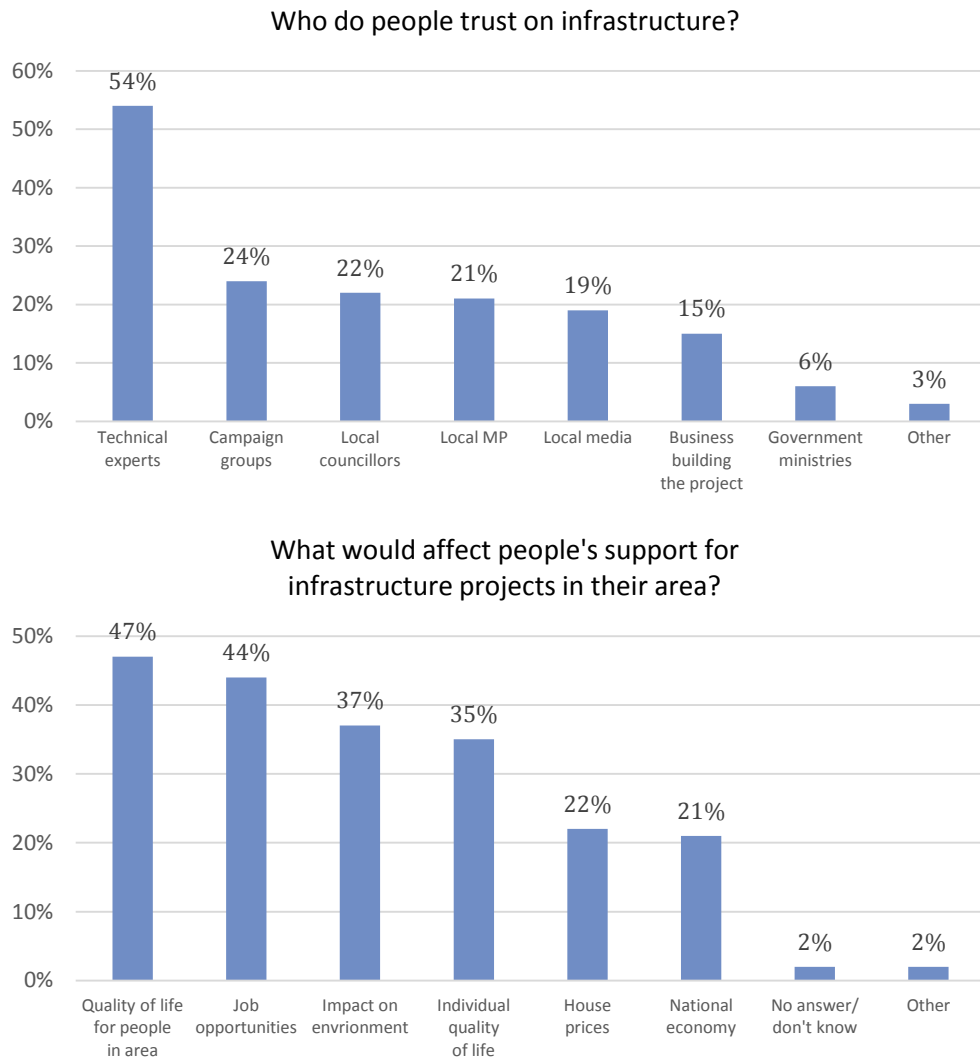
Polling suggests that people value local benefits of infrastructure on a range of quality of life and economic factors so a focus on national economic growth is unlikely to build consensus for action. The same surveys indicate that only 6% of people trust national politicians to explain infrastructure choices. Local government and campaign groups are more trusted so devolution can reduce public objections to projects<sup>63</sup>.

---

<sup>62</sup> E3G, 2015, **Harnessing Demand Side Resources in Electricity Markets**

<sup>63</sup> CBI, 2014, **Building Trust: Making the Public Case for Infrastructure**

Figure 6: Polling on Public Attitudes to Infrastructure (Source: CBI 2013)



The mismatch between public and government infrastructure priorities is also shown by the low public support for flagship projects such as HS2<sup>64</sup> and the preference for investment in projects with greater perceived social value such as energy efficiency for the fuel poor<sup>65</sup>.

The English devolution process is an opportunity to empower local authorities but uncertainty surrounding the level of policy and regulatory support for local governance is stifling transformational reforms. While transportation and energy efficiency retrofits have emerged as a focus of English devolution, other linked areas

<sup>64</sup> CIHT, 2015, **Public Support for HS2 Hits New Low Says Poll**

<sup>65</sup> Energy Bill Revolution, 2014, **TNS Public Polling for Energy Bill Revolution**

---

such as energy supply and grids, water and flood defence are only being devolved currently to the Scottish and Welsh Administrations.

The main argument against devolution of infrastructure to English cities is a perceived lack of capacity, which is being worsened by spending cuts. Under the current approach, autonomy is earned based on capacity to deliver cost effective infrastructure and public services. There are good reasons for this as successful decentralisation depends on effective governance and it is important to ensure efficient use of public money. However, this also puts English cities in a ‘Catch 22’ position in which their inability to demonstrate capacity over a full set of infrastructure areas means they are unable to develop local capacity and deliver the benefits of integration and innovation.

To overcome the capacity gap, government should first adopt a medium term goal of devolving full infrastructure management control to all English City regions by 2025. This process should be front-loaded through a competitively selected group of “smart infrastructure zones” covering up to 30% of city GDP. These zones would be given strong support and incentives to pioneer new approaches. The lessons from these first-movers would be used to re-design the overall English regulatory system, which would then apply to all major cities.

Devolution also requires stronger, more explicit management of critical networks and resilience at a national level and with a focus on systems interdependencies. Increased international economic integration requires clearer national management of energy security and interconnection, cyber-security, international transportation and the related national strategic transport network. Lack of resilience at the local level has national level implications and requires improved national oversight and benchmarks for local infrastructure risk management and climate risk planning.

Beyond direct national benefits, moving towards a smart, low carbon and decentralised infrastructure policy offers significant export opportunities. The global low carbon economy is worth over \$5 trillion and is growing at over 4% a year. The UK low carbon economy has been growing at over 7% per annum since 2010 and is five times larger than the aerospace industry<sup>66</sup>. The UK has many world-leading firms in integrated infrastructure planning and delivery that could benefit from a stronger home market<sup>67</sup>. China alone will spend over \$8 trillion in urban infrastructure and \$1 trillion in clean energy to 2020<sup>68</sup>. Global infrastructure investment is estimated at \$90 trillion to 2030 with 80% of this in emerging economies that need external expertise to deliver the shift to efficient, resilient and clean infrastructure<sup>69</sup>.

Reforms to incentivise delivery of smarter, cleaner and more resilient infrastructure systems will underpin UK competitiveness at home, and lay the foundation for UK firms to supply solutions that fast growing, emerging economies actually want.

---

<sup>66</sup> BIS, 2015, **The Size and Performance of the UK Low Carbon Economy**

<sup>67</sup> BIS, 2013, **The Smart City Market: Opportunities for the UK**

<sup>68</sup> E3G, 2011, **Chinese Challenge or Low Carbon Opportunity?**

<sup>69</sup> The New Climate Economy, 2014, **Better Growth, Better Climate**

---

## CHAPTER 4

# REFORMING THE MANAGEMENT OF UK INFRASTRUCTURE SYSTEMS

The UK must avoid a false choice between driving quality, resilience and quantity in its infrastructure systems. Delivering world-class performance on each objective requires reforms to ensure government explicitly considers the strategic implications of future trends and, as far as possible, avoids building expensive “white elephants”. The aim must not be to predict the future, but to ensure that the future is not being wilfully ignored in order to simplify decision making.

The UK has many existing strengths to build on. The existence of a strong National Security Council structure with a National Risk Assessment of critical infrastructure resilience and emergencies gives a focus for managing long term UK resilience. However, the definition of resilience is currently too narrowly focused on national supply disruption and should be expanded to include significant economic impacts due to international resource price volatility and/or supply disruption. The role of the Cabinet Office should be extended from emergency planning to responsibility for working across government to oversee the effective consideration of the resilience implications in all investment plans and decisions.

The experience of world class bodies such as UK Foresight and the Committee on Climate Change shows how complex and uncertain trends and technologies can be assessed in an open and participatory way to inform a comprehensive risk management strategy. The UK should develop common, consistent and robust scenarios to underpin all infrastructure planning and assessment which have been publically tested and scrutinised.

Moves to widen the scope of infrastructure have seen energy efficiency included in the National Infrastructure Plan, although only smart meters are as yet identified as a priority project. The Scottish Government has made home energy efficiency insulation an infrastructure priority. The Natural Capital Committee, Environment Agency and Forestry Commission have all produced recommendations for integrating “green” infrastructure more effectively into mainstream planning and spending decisions.

However, managing the UK infrastructure system cannot be treated as just a technocratic problem. Political oversight is needed to define key performance benchmarks on resilience, allocation of costs to users and/or taxpayers and strategic judgments on how to respond to future challenges and uncertainties. Executive decisions at all levels would benefit from stronger Parliamentary oversight and better public transparency over public value and resilience assessments. The Public Accounts

---

Committee in 2014 issued a report which commented on the lack of UK Parliamentary oversight over infrastructure spending which is paid for by consumer bills<sup>70</sup>.

The seeds of integrated assessment and management of UK infrastructure systems have been planted with the creation of the Infrastructure and Projects Authority, the Economic Regulators Network and consideration of interdependencies in the Sectoral Resilience Plans. The National Infrastructure Commission will likely absorb some of these functions. These bodies need to adopt a more systematic approach to assessing long term system performance and resilience, rather than just examining individual projects. This need was identified in previous reviews by Infrastructure-UK and was subject of a 2016 inquiry by the Public Accounts Committee but progress in improving assessment has been slow and patchy<sup>71</sup>.

Devolution of infrastructure powers is underway to Scotland and Wales, and the process of English City Region devolution is an opportunity to define a clear target for delivering similar reforms in England. Devolution reforms should allow citizens to prioritise investment based on local preferences including deciding areas where they want to go beyond minimum national standards, such as air and water quality, extreme weather resilience or access to local renewable energy.

The Smart Cities Forum has defined additional capacities that cities would need to deliver modern infrastructure projects, particularly in improving capacity for project development and innovative finance. Moving to a fully devolved system requires stronger supporting institutions to work with cities on delivery, including financial support from the Green Investment Bank.

The UK has a range of innovation programmes for infrastructure such as the £500m Ofgem smart grids programme, the Ofwat Innovative Funding Initiative and the Future Cities Catapult. These are disconnected and underemphasise future integration and dependencies between infrastructure systems; though the 2015 Productivity Plan does require all departments to develop a Digital Transformation Plan.

Innovation funds should be better used to incentivise innovative and integrated infrastructure. Government needs to be a more intelligent (monopoly) consumer in using the infrastructure programme itself to drive innovation and create new markets. Incentives for low-embodied carbon construction should be a high priority as this area is under-served by current markets but has huge global market potential.

---

<sup>70</sup> House of Commons Committee of Public Accounts, 2014, **Infrastructure Investment: The Impact on Consumer Bills**

<sup>71</sup> House of Commons Committee of Public Accounts, 2016, **Delivering Major Projects in Government**

---

# RECOMMENDATIONS

## **Better management of future performance and resilience**

### **1. Define infrastructure**

Infrastructure systems cannot be effectively designed, assessed or managed when major elements of enduring investment which determine future demand levels and which can substitute for supply side options are ignored. The working definition of infrastructure should be expanded to include new housing/buildings, energy efficiency retrofitting in the existing building stock, distributed energy systems, broader energy efficiency measures in electricity systems, and based on advice from the Natural Capital Committee, include “green” infrastructure such as forests and natural flood defences.

### **2. Collaborate on integrated demand and risk scenarios**

Design of future infrastructure systems requires coherent and up to date scenarios of the technological, demographic, environmental and policy landscape the UK faces. These scenarios must cover both domestic and international forces and potential shocks over the working lifetime of infrastructure investments. The National Audit Office, National Infrastructure Commission, Economic Regulators Network, Climate Change Committee and Natural Capital Committee should produce consistent assessments every 5 years of forward demand and risk scenarios for the UK covering all major infrastructure systems. The scenarios will be based on publically-available assumptions and models which are open source and released for public consultation, challenge and improvement.

### **3. Establish a National Resilience Office**

With increasing convergence between infrastructure systems, exposure to linked and trans-boundary risks, and a move to greater devolution it is critical that the overall resilience of UK infrastructure is better managed. Clear responsibility for infrastructure resilience should be given to a new National Security Council (NSC) ministerial sub-committee supported by a National Resilience Office (NRO) built on the relevant existing Cabinet Office units. The NRO would be responsible for assessing the overall resilience performance of UK infrastructure, ensuring resilience is built in from the design and investment phase, as well as absorbing existing resilience and Civil Contingency responsibilities.

### **4. Create a requirement for strategic risk management**

Government departments have existing requirements for short term delivery management and Sectoral Resilience Plans. Departments (and in due course cities and regions) should also demonstrate to the NRO and NAO adequate long term strategic risk management processes which ensure their existing and planned infrastructure portfolio will deliver value for money and resilience against the full range of UK demand, supply and risk scenarios. The operation of departmental

---

strategic risk management systems should become a key indicator in departmental management performance.

#### **5. Conduct a post-Paris climate risk assessment**

The government should undertake a review of the changes to management of energy security and climate impact risks in light of the outcome of the Paris Climate Change Agreement. The NRO should take responsibility for coordinating the statutory Climate Change Risk Assessment report to Parliament in January 2017.

### **Improving public oversight and value for money**

#### **6. Create a parliamentary Joint Committee on Infrastructure**

Parliament must be able to oversee value for money, resilience and delivery of the UK infrastructure programme as a whole and through new executive structures such as the National Infrastructure Commission and the Infrastructure and Projects Authority. This could be achieved by establishing a parliamentary Joint Committee on Infrastructure – analogous to the Joint Committee on the National Security Strategy – with a dedicated chair and members made up of the chairs of the relevant departmental select committees. The Parliamentary Committee would have the power to call the Prime Minister, Chancellor of the Exchequer and Departmental Heads to give evidence on the value and impact of UK infrastructure spend.

#### **7. Conduct a zero-base review of the UK infrastructure portfolio**

Based on the five-yearly scenarios the NAO should work with government departments to undertake a zero-base review of the UK infrastructure portfolio. The review would identify where major changes in underlying prices, trends and risks make planned projects poor value for money, and identify gaps or reprioritisation needed in the current portfolio. The review would report jointly to the government and the Joint Committee on Infrastructure in 2017.

#### **8. Improve transparency of spending and business cases**

The public has a right to know that its money is being well spent, but it is hard to critically examine the business case for most national and local infrastructure. Despite enhanced freedom of information rights much of the information is withheld under rules of commercial confidentiality. In line with government policy on transparency all infrastructure business cases should be made public from when the Strategic Outline Business case is submitted by departments or local authorities. A policy should be adopted that only minimal redactions should be made for exceptional cases of commercial confidentiality.

---

## Setting a pathway to fully devolved infrastructure

### 9. Core infrastructure devolution

Alongside devolution of transport spending the government should include domestic energy efficiency retrofitting and low carbon heating/cooling as part of the core devolution package in the current round of devolution to Core Cities. These areas should be prioritised in UK projects proposed for the European Fund for Strategic Investment.

### 10. Set timeframe for full infrastructure devolution

Set a firm pathway for full devolution of infrastructure powers to English Cities and regions by 2025 which gives parity with powers devolved to Scotland and Wales. The National Infrastructure Commission should provide recommendations in 2016 on a pathway to devolve powers in England including how to improve city delivery capacity to meet this timetable.

### 11. Drive regulatory and market innovation through smart infrastructure zones

To develop new models for integrated and smart infrastructure hold a competitive bid process for 2-3 city regions to become “smart infrastructure zones”. The winners would receive additional support in delivering these from Future Cities Catapult, Infrastructure-UK, Green Investment Bank and the Regulators Network.

### 12. Give citizens more control over infrastructure choices

As part of the devolution process give local governments control over decisions on air quality, fuel poverty, energy security and costs, transport safety, noise, and extreme weather resilience. This would be supported by enhanced public rights to access data on delivery, pollution, risk and resilience.

## Incentivising infrastructure innovation and integration

### 13. Establish an infrastructure innovation fund

Increase incentives for innovative and integrated infrastructure projects by setting aside 15% from the public infrastructure budget for highly innovative projects and those involving cooperation between multiple departments, local authorities and/or regulatory authorities. This would build on the success of similar integrated funds developed for UK security and conflict prevention. This funding would be allocated from year-ahead budgets, and if there is a lack of projects which meet the transformational criteria the funding would be returned to the main infrastructure budget for allocation to departments.

### 14. Reform public procurement

Reform performance guidelines for all public and public-private infrastructure procurement which incentivise higher resource efficiency and lower embedded carbon in construction; for example, using a shadow carbon price on embedded carbon and preferences for use of recycled resources.