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# Infrastructure and Growth

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# Infrastructure and Growth

## *“Launch Version”<sup>1</sup>*

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**Novella Bottini, Miguel Coelho, and Jennifer Kao**

Prepared for the Growth Commission

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<sup>1</sup> **PRELIMINARY VERSION—Not to be quoted or cited. This paper was produced by the Growth Commission’s Secretariat to inform the thinking of the Commissioners. The analysis does not necessarily reflect the views of the Commissioners. In contrast, the proposals are those of the Growth Commission report.**

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## Table of Contents

Executive Summary.....	5
1. The Economics of Infrastructure.....	7
1.1. Infrastructure and Growth .....	7
1.2. The Changing Role of Infrastructure .....	8
1.3. UK Infrastructure Performance .....	9
1.3.1. Energy .....	10
1.3.1.1. Energy Risk.....	10
1.3.1.2. Current Institutional Architecture .....	12
1.3.2. Transport.....	14
1.3.2.1. Transport Risk.....	14
1.3.2.2. Current Institutional Architecture .....	16
1.3.3. Other areas .....	17
1.3.3.1. Housing .....	17
1.3.3.2. Broadband.....	18
2. Causes of Underinvestment: Risk and Bias .....	19
2.1. Political Risk .....	20
2.2. Analytical Risk .....	22
2.3. Policy bias .....	22
2.3.1. The Evaluation Process: Cost-Benefit Analysis.....	22
2.3.2. Limitations of the Planning System and Compensation Mechanisms.....	24
2.3.2.1. The Traditional Approach to Compensation—Communal Compensation .....	26
2.3.2.2. International Examples of Successful Compensation .....	28
2.3.2.3. On-going Efforts to Improve Compensation.....	29
2.3.3. Public Accounting.....	30
3. Core Policy Recommendations .....	31
3.1. Core Recommendations on Infrastructure .....	31
3.2. Other Areas to Support Infrastructure .....	35
3.2.1. Public Sector Accounts .....	35
3.2.2. Road Pricing.....	35
3.2.3. Housing .....	36
3.2.4. Broadband.....	36
Appendix A: Road Pricing.....	37
Appendix B: Theory of Compensation.....	38
References .....	40

## Executive Summary

- Energy, water, transport, digital communications, waste disposal networks and facilities, are essential ingredients for the success of a competitive modern economy. Research has shown that well-designed infrastructure investments have long-term economic benefits; they can raise economic growth, productivity, and land values, while providing significant positive spillovers. However, investing wisely in infrastructure is critically important as over-investment can lead to projects that are inefficiently large, and therefore have low marginal returns.
- Growing evidence suggests that the UK performs poorly by international standards. For example, the World Economic Forum ranked the UK 24th for “quality of overall infrastructure” in its 2012 report on global competitiveness.
- UK performance is relatively weak in energy and transport sector, echoing long-standing concerns of underinvestment: transport (road and air) congestion is a growing concern; air and rail delay levels are among the worst in Europe; and the energy sector faces increasing pressure to decrease carbon emission with negative impact on energy supply.
- What sets investment in infrastructure apart from other types of investment is its high-risk, long-term, capital intensive nature, reflected in the creation of long-lived assets with high sunk costs. The resulting gulf between marginal and average costs creates a time-inconsistency problem as investors always face the problem that they will be “held up.” This requires suitable government intervention.
- Government intervention, in turn, exposes infrastructure investment to an additional layer of risks and decision-making biases – the root cause of underinvestment in UK infrastructure:
  - *Political risks* - reflecting the inability of the political system to deliver cross-party consensus around strategic plans for infrastructure and stable policy frameworks to support their implementation;
  - *Analytical risks* - reflecting the dual relationship between the prevailing political ideology and economic mainstream;
  - *Unbiased project appraisal* – reflecting the deficit in project evaluation grounded in sound and independent expert analysis and comprehensive assessment of policy alternatives;
  - *Limitations of the planning system and compensation mechanisms*— reflecting a current planning system that does not properly share the asymmetric benefits of development; and
  - *Public accounting distortions* - reflecting practices that fail to incorporate the value of public sector assets and concentrate solely on public sector debt.
- Policy recommendations:
  - Strengthening the governance, strategic planning and finance of major infrastructure investment through the creation of **a new institutional**

**architecture.** Key elements of this new architecture are:

- ✓ an *Infrastructure Strategy Board (ISB)* to provide independent expert advice to parliament to guide strategic priorities;
  - ✓ an *Infrastructure Planning Commission* to support the implementation of those priorities with more powers to share the gains from infrastructure investment by more generously compensating those who stand to lose from new developments;
  - ✓ an *Infrastructure Bank* to facilitate the provision of finance, to bring in expertise and to work with the private sector to share, reduce and manage risk.
- **Improving public accounting** to generate management tools that report a comprehensive range of data on infrastructure assets (such as the Whole of Government Accounts) and effectively use these new accounts as the basis for policy-making;
  - Introduce **regulated road pricing systems** to generate dedicated revenue streams that would provide a long-term solution to the problem of road investment, maintenance, and finance;
  - Address the under-supply of **housing** in the UK in a manner that is naturally complementary to infrastructure goals through employing the strategic advantages of the ISB and IPC. Institutionalise a flexible system of compensation for those who stand to lose from new developments; and
  - Continue to develop and improve the UK's **broadband** infrastructure in order to respond flexibly and promptly to a rapidly changing technological environment.

# 1. The Economics of Infrastructure

## 1.1. Infrastructure and Growth

Infrastructure<sup>2</sup> is a heterogeneous term, including physical structures of various types used by many industries as inputs to the production of goods and services (Chan et al., 2009). This description encompasses “social infrastructure” (such as schools and hospitals) and “economic infrastructure” (such as network utilities). The latter includes energy, water, transport, and digital communications. They are the essential ingredients for the success of a modern economy and the focus of this paper (Stewart, 2010).

Conceptually, infrastructure may affect aggregate output in two main ways: (i) directly, considering the sector contribution to GDP formation and as an additional input in the production process of other sectors<sup>3</sup>; and (ii) indirectly, raising total factor productivity by reducing transaction and other costs thus allowing a more efficient use of conventional productive inputs. Infrastructure can be considered as a complementary factor for economic growth.

How big is the contribution of infrastructure to aggregate economic performance? The answer is critical for many policy decisions – for example, to gauge the growth effects of fiscal interventions in the form of public investment changes, or to assess if public infrastructure investments can be self-financing.

The empirical literature is far from unanimous<sup>4</sup>, but a majority of studies report a significant positive effect of infrastructure on output, productivity, or long-term growth rates. Infrastructure investment is complementary to other investment in the sense that insufficient infrastructure investment constrains other investment, while excessive infrastructure investment has no added value. To the extent that suboptimal infrastructure investment constrains other investment, it constrains growth (Newbery, 2012).

Empirical estimates of the magnitude of infrastructure’s contribution display considerable variation across studies<sup>5</sup>. Overall, however, the most recent literature tends to find smaller (and more plausible) effects than those reported in the earlier studies (Aschauer, 1989, Calderon et al, 2011), likely as a result – at least in part – of improved methodological approaches<sup>6</sup> that also allow better estimates of the causal

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<sup>2</sup> “Infrastructure has been understood to include many different things, and a universally accepted definition has remained elusive. One well-known attempt reads (Gramlich 1994): “The definition that makes the most sense from an economics standpoint consists of large capital intensive natural monopolies such as highways, other transport facilities, water and sewer lines, and communications” (in Wagenvoort et al. 2010).

<sup>3</sup> For example, the total direct contribution of the energy sector to the UK economy in 2011 (measured by contribution to GDP) was £20.6bn, an increase from 2007 of 16 per cent (Energy UK, 2012).

<sup>4</sup> E.g. Gramlich (1994)

<sup>5</sup> See Romp and Haan (2007) for a review of the relevant empirical literature.

<sup>6</sup> The empirical literature on the contribution of infrastructure to aggregate output is subject to major caveats, such as the fact of ignoring the non-stationarity of aggregate output and infrastructure capital, potential simultaneity between infrastructure and income level and potential heterogeneity across countries (Calderon et

relationship. This empirical correlation is the subject of considerable heterogeneity depending on the countries and time periods under study, possibly indicating asset-quality issues, complementarities with other production factors, non-linearity due to the network character of infrastructure<sup>7</sup>, and larger policy and institutional factors that still need to be better understood<sup>8</sup>.

## 1.2. The Changing Role of Infrastructure

It is necessary to realign the nation's infrastructure to the changing world economy. The UK's infrastructure must be secure, flexible, and well inter-connected in order to support the UK's long term economic growth.

Infrastructure security and stability concerns the quantity of *spare capacity (or security of supply)*. Instead of acting on the efficiency frontier, infrastructure projects must operate with spare capacity to contribute to economic growth through ensuring reliable service provision in energy and transport. For instance, it was the spare capacity generated by Victorian and later transports investments that provided for the structural shifts in London jobs over the past forty years, from manufacturing (mainly in outer London) to services (much more centrally located). Crossrail is another example: it has been estimated that without it 35,000 people would be crowded out of access to Central London jobs by 2035 (Rosewell, 2012). (This represents a loss of additional output to the UK economy of £80bn, simply on the basis of the higher productivity which is generated across all activities in a dense location (Rosewell, 2012)).

*Spare capacity* is a necessary condition for a properly functioning system. To assure the level of spare capacity in the absence of storage and demand, the system needs to have excess supply. However, no rational profit-seeking company will deliberately create conditions of excess supply, since it would produce a marginal cost lower than the average cost (Helm, 2012). Given this market failure, the Government needs to create the right incentives to ensure security of energy supply, since the social and economic costs of a black-out or trains crash (due to insufficient supply) are much higher than the company's losses.

*Greater flexibility* in infrastructure systems is necessary to respond to changing economic needs. For instance, within the energy sector the UK needs to ensure energy security and at the same time meet the de-carbonizing target in the coming decades. If

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al, 2011; Esfahani and Ramirez, 2004)

<sup>7</sup>This problem mainly arise using a Cobb-Douglas production function since under this functional form the elasticity of substitution amongst factors is constrained to be one. The key argument with infrastructure is complementarity. Given that the assumptions underlying a Cobb-Douglas production function don't account for it, the infrastructure's impact on growth could be underestimated.

<sup>8</sup>Egert et al. 2009 sought to identify the wider economic benefits of transport infrastructure investments using a panel growth regressions framework for 1960– 2005. The results suggested massive variation across the OECD both in signs and magnitudes and the authors conclude that the impacts are country-specific and depend inter alia on the pre-existing level of provision. In the UK case, both road and rail infrastructure investments were found to have significant indirect productivity impacts. This finding is consistent with recent evidence of quite strong agglomeration effects on productivity in the UK (Graham 2007, Crafts 2009).

energy could be supplied by different sources both aims could be easily achieved, but this would require a different - and more flexible - energy system than the one currently in place. The solution can be the development of a “supergrid”, i.e. an international network of electricity cables, which integrates offshore renewables generation into the transmission system, as well as allowing electricity to be traded across borders. The opportunity to connect houses, and hence the final consumer, to the grid (through the smart grid) would further increment the flexibility and efficiency of energy supply<sup>9</sup>. London’s “Oyster” card is another example of flexible technology that has the potential to introduce flexible pricing policies to public sector networks (for example using the same underground ticket on urban rail) (Eddington, 2006)

Finally, *interconnection and complementarities* across different infrastructure sectors are key elements for increasing service efficiency, supporting the adoption of innovative technologies and supporting growth. Good connection between cities and airports, via rail, roads and underground, decrease the travel time and costs and increase airports’ appeal for both airlines companies and passengers. Other examples include broadband and ICT, which play a critical role in the development, installation and operation of the smart grid across UK: smart grids manage the supply and demand of power through the national distribution network more effectively by introducing high-tech communication to the system. Interconnection influences also the implementation costs and feasibility if a given project. Moreover, in a crowded and busy network decisions have knock on effects – for example the absence of Crossrail would influence the “business as usual” benefits and costs associated with a dense location (Rosewell, 2012).

### **1.3. UK Infrastructure Performance**

Over the years, the UK has developed mature and extensive infrastructure networks that are among the largest and most widely used in Europe. While there has been a strong history of investment, levels have fluctuated significantly over time. The move of the water, energy and communications sectors to regulated private ownership during the 1980s provided a basis for renewal of major parts of these networks<sup>10</sup>. At the same time, and partially as a result of the withdrawal of state funding from these areas, public capital spending fell from the late 1960s onwards - net public investment has never regained the 1968 level, either in absolute terms or as a share of GDP<sup>11</sup>.

Growing evidence suggests that the UK performs poorly by international standards. The World Economic Forum ranked the UK 24th for “quality of overall infrastructure” in its 2012 report on global competitiveness. The Doing Business ranks access to UK electricity supply 54th in the world and OFGEM (Office of the Gas and Electricity Markets) warns of power shortage risk by 2015. The Eddington Review (2006) cited a

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<sup>9</sup> For a review on smart grids see IEA (2011); Deutsche Bank Research (2011); Greenpeace (2011), Patsy (2012b); House of Commons (2011); Macilwain, 2010 and Nature (2010).

<sup>10</sup> For example, £85bn has been invested in water infrastructure alone since privatization (Water UK, 2010).

<sup>11</sup> As a share of GDP, net public investment fell from a level of 5.6 per cent in 1975-1976 to 3 per cent in 2008.

potential cost of £22 billion per annum in increased congestion by 2025 if the transport network does not keep up with demand.

This report focuses mainly on Energy and Transport where the problems are well understood and where potential growth implications are likely to be more severe.

Other areas that deserve attention are broadband and housing: the former given its critical role in the UK economic system and its future competitiveness, the latter for the low investment level and the increasing housing demand.

### 1.3.1. Energy

#### 1.3.1.1. Energy Risk

The UK, like other OECD countries, faces significant challenges in its aim to achieve a sensible balance of *security*, *stability*, and *affordability* in energy supply, while at the same time complying with relatively stringent *carbon targets*.

Energy security is determined by the margin of spare generating capacity in excess of maximum electricity demand. This should be maintained roughly at around 20 per cent. However, within the next ten years, over a fifth of the UK's electricity generating capacity (built in the 1960s and 1970s) will have come offline pushing the 'capacity margin' to fall below 10 per cent by 2015 (Redpoint - DECC, 2010 and Ofgem, 2012). This problem is becoming more pressing compared with previous decades<sup>12</sup>.

Energy stability refers to the ability to provide a constant supply of energy. This could become compromised by a shortage in spare capacity. While nuclear power<sup>13</sup> and gas<sup>14</sup> would ensure a stable energy supply, renewables energy generators (such as wind farms) are characterised by intermittent supply and require additional flexible reserves to prevent blackouts.

The decarbonisation objective is based on EU and UK carbon targets. At the inception of the Kyoto Protocol, the EU-15 committed to reducing emissions by 8 per cent, on average, over 2008-12, compared with base-year emissions. Under the EU's burden-sharing agreement the UK committed to a 12.5 per cent reduction in emissions. More recently the UK has introduced a system of carbon budgets that set legally binding

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<sup>12</sup> The 1980-82 recession changed the composition of the economy and was followed by a process of relative deindustrialisation. The capacity built in the 1970s was in great excess to demand for electricity in 1980s and 1990s. During the 1990s there was the first 'dash-for-gas' partly linked to the privatisation process and regulator's pressures in the name of 'competition' and partly for environmental reasons since the UK began to implement a new set of climate-change policies directly targeted at energy efficiency and emission reductions. Finally, the great recession since 2007 has set GDP in 2012 at a much lower level than expected in 2005, also lowering energy demand.

<sup>13</sup> However, nuclear power is costly, slow to build and is subject to high levels of social concern.

<sup>14</sup> Given the diverse sources of energy supply emerging (pipelines, LNG terminals, even possibly shale gas at some future date) as well as storage options, gas security issues can be managed without excessive cost. Moreover liquid markets allow gas to flow freely within the whole of the EU in the event of localised disruptions to pipelines.

emissions limits over five-year periods for the periods 2008-12, 2013-17, 2018-22 and 2023-27. The average level of emission in the fourth budget (2023-27) will have to be 50 per cent lower than in 1990. These new climate-change policies have supported the decline in energy CO<sub>2</sub> emission per head during the 2000s, after the 'dash for gas' and the privatisation's effect decline started to vanish<sup>15</sup>. Indeed, UK has registered the largest energy emissions decrease between 1990 and 2005, when the average value was on average 0.7 per cent per year per head, well above the OECD, EU-15 and world averages. These reductions were strongly linked to the privatisation of the electricity industry in the early 1990s. Indeed, privatisation was accompanied by reduced gas prices and improvements in electricity generation technology, which favour greater use of cleaner energy sources, especially gas (the so-called 'dash for gas'), which replaced coal and oil (Bowen and Ridge, 2011).

The EU has also adopted a target of driving 20 per cent of final energy demand from renewables by 2020 and has agreed on individual country targets to achieve this. The UK's target is 15 per cent. Although this target is not accompanied by any EU-wide policy instrument, over the past decade the UK has promoted different policies that support renewable energy, aim to reduce the carbon intensity of energy and diversify supply<sup>16</sup> (Bowen and Ridge, 2011). In sharp contrast with the performance on emission reductions, the contribution of renewables to energy supply and electricity generation in the UK is lower -both in absolute and relative term- than on other OECD countries. Indeed, most of the UK's electricity is produced by burning fossil fuels, mainly natural gas (47 per cent in 2010) and coal (28 per cent). Only 16 per cent of UK electricity comes from nuclear reactors and renewable energy (mainly wind, wave, marine, hydro, biomass and solar) made up 7 per cent of electricity generated in 2010 (Energy UK, 2012). Stronger measures are therefore required to accelerate the transition from fossil-fuel-based electricity generation towards cleaner energy supplies to sustain the downward trend in emissions and meet the EU renewable target (Bowen and Ridge, 2011).

All these challenges imply higher costs for the end-users that rise concerns about affordability for households and cost-efficiency for firms. Germany's biggest companies have recently warned that Europe's ability to compete against the US as a manufacturing centre is being damaged by rising energy costs as North America benefits from cheap natural shale gas.

However, supply-side policies alone would not achieve the targets. In order to decrease the energy demand, both consumers and businesses have to be empowered with facts

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<sup>15</sup> The economic downturn brought an extra stimulus to the emissions' decline during this period (Bowen and Ridge, 2011). However, the emission reduction has been slower than in the previous decade.

<sup>16</sup> The contribution of renewables to energy supply and electricity generation in the UK is lower -both in absolute and relative term- than on other OECD countries. Indeed, most of the UK's electricity is produced by burning fossil fuels, mainly natural gas (47 per cent in 2010) and coal (28 per cent). Only 16 per cent of UK electricity comes from nuclear reactors and renewable energy (mainly wind, wave, marine, hydro, biomass and solar) made up 7 per cent of electricity generated in 2010 (Energy UK, 2012). Stronger measures are therefore required to accelerate the transition from fossil-fuel-based electricity generation towards cleaner energy supplies to sustain the downward trend in emissions and meet the EU renewable target (Bowen and Ridge, 2011).

to make the right decisions on their energy consumption and become greener (Helm, 2010b and CBI, 2012b).

### 1.3.1.2. Current Institutional Architecture

The economics profession is divided on the specifics of an optimal energy policy framework. This divide manifests itself in current debate around energy market reform, with some commentators advocating the need for a radical departure from current government policy to increase simplification, competition and competitive bidding (e.g. Helm, 2012), while others defend that moderate changes to the current system could enable the UK to achieve its energy objectives (e.g. Newbery, 2012).

However, there seems to be broad consensus – among academics and business alike – that the current policy arrangements have failed to deliver a stable, credible long-term policy/regulatory environment, capable of attracting private investment in the scale required to meet the challenges described above. In particular, the reliance of most low-carbon technologies on government policy presents a unique challenge to investors, who often see policy as uncertain and susceptible to change – either through *ad hoc* tinkering or major changes in political objectives (CBI, 2012b)<sup>17</sup>

Since the late 1980s the *Department of Energy and Climate Change* (DECC) have proposed and developed a complex set of measures to reduce emissions. Most domestic UK policies have been designed to be ‘market friendly’ such as quantity-based instrument (such as the Renewables Obligation (RO)<sup>18</sup>), or price-based instruments (such as the Climate-Change Levy (CCL)<sup>19</sup>). Several schemes have been hybrids or have taken the form of regulations mandating specific actions (such as labelling requirements for energy efficiency). Owing to this multitude of energy measures, many policies have risked to overlap each other (Bowen and Ridge, 2011). The Electricity Market Reform is geared towards simplifying the energy market providing a clearer framework for investment. But the fact that it came after many years of indecision means that it will

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<sup>17</sup> For example, the slippage of the review of support for renewable energy generation under the existing Renewables Obligation mechanism, and the uncertainty over the level of subsidy for wind projects causes uncertainty about the long-term energy market framework. This creates major challenges in term of planning and financing projects with negative outcomes on private investment. Of equal concern are the sudden and unexpected policy changes that have recently been implemented, including the increase in the North Sea oil and gas tax, the removal of revenue recycling from the Carbon Reduction Commitment (CRC) and the cut to the solar photovoltaic feed-in tariff. These have been damaging to business confidence, with implications not just for immediate investment decisions but for longer-term trust in government policy (CBI, 2012b).

<sup>18</sup> The RO was introduced in 2002 and requires electricity end-suppliers to purchase a certain fraction of their annual electricity supply from producers using specific renewable technologies, and they receive tradable Renewables Obligation Certificates (ROCs) for doing so. The supplier can also ‘buy out’ the obligation by paying a set price per MWh. The buy-out revenue is recycled to participating suppliers in proportion to their ROCs.

<sup>19</sup> It was introduced on 1 April 2001, effectively replacing the Fossil Fuel Levy. It is a downstream tax on non-domestic energy use by industry and the public sector, designed to incentivise energy efficiency and emission reductions, with part of the revenue being used to reduce National Insurance contributions. Energy-intensive firms can receive up to an 80 per cent discount if they join a Climate Change Agreement (CCA), which requires meeting energy efficiency or carbon-saving targets. Renewable electricity suppliers are exempt from the CCL. Receipts from the CCL amounted to £0.7 billion in 2009.

take time to build confidence. The four pillars of Energy Market Reform are (Patsy, 2012a):

- **Feed-in-tariff** with Contract for Difference (FIT CfD) to provide long term contracts of price support to energy different generation types. It is a static payment on top of that obtained from selling electricity in the wholesale market;
- **A capacity mechanism** to encourage flexible reserve/cushion plants or demand reduction measures to ensure the 'appropriate' level of energy supply and spare capacity;
- **Carbon price floor** to 'underpin' carbon price support providing a minimum guaranteed level. This would provide a more stable and certain target than the EU emissions trading scheme (ETS);
- **An emissions performance standard (EPS)** to limit how much carbon coal power stations can emit; so that no new coal is built without demonstrating carbon capture and storage (CCS) technology or being 'CCS-ready' (not necessarily fitted).

A number of bodies play advisory, implementation, and accountability roles. The *Department for Energy and Climate Change (DECC)* is responsible for the definition of energy policy goals and the design of policy frameworks to achieve them.

DECC also has some specific functions in the energy sector, including<sup>20</sup>:

- Granting consent for power stations;
- Defining the extent of the regulated industry by deciding on licence exemptions;
- Appointing members of the Gas and Electricity Markets Authority (GEMA) – which sets Ofgem's strategy;
- Using vetoing power on any proposal by the regulator to modify licences;
- Setting wider social and environmental policy relating to energy, and deals with the growing international energy issues – specifically liberalisation of the EU energy market, and imports of oil and gas;
- Looking after areas such as energy efficiency and fuel poverty.

The *Energy and Climate Change Committee* is appointed by the House of Commons to examine the expenditure, administration and policy of the DECC and its associated public bodies.

In 2008, the Climate Change Act set up an independent body, the *Committee on Climate Change*. The Committee is an independent and authoritative body advising the UK Government and devolved administrations on carbon budgets<sup>21</sup> and climate change issues in the UK<sup>22</sup>. It monitors progress towards meeting carbon budgets and

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<sup>20</sup> For more information see: <http://www.decc.gov.uk> – Regulation of GB Energy Market.

<sup>21</sup> The budgets define the maximum level of CO<sub>2</sub> and other greenhouse gases which the UK can emit in each 5 year budget period, beginning with 2008-12.

<sup>22</sup> In particular it provides advice on the preparation of the UK Climate Change Risk Assessment and progress towards implementation of the UK Government's National Adaptation Programme; and fulfils requests for

recommends actions to keep budgets on track; conducts independent analysis into climate change science, economics and policy as requested by the national authorities in collaboration with a wide range of organisations and individuals (CCC, 2010 and 2012).

*Ofgem* (Office of the Gas and Electricity Markets), the independent energy regulator established by the Utilities Act 2000, is responsible for regulation of the energy markets in England, Scotland and Wales<sup>23</sup>. Gas and electricity companies generally need a license to operate and Ofgem deals with this duty by issuing, modifying, enforcing and revoking licenses. Its additional key functions include setting price controls in the natural monopoly licensed sectors; and investigating and penalizing those violate the license conditions. Ofgem's independence ensures that energy regulation is free from political interference, and helps avoid uncertainty in the energy markets, which is one of the main constraints in infrastructure investment. Ofgem's main objective is to protect energy consumers' interests wherever appropriate through effective competition or by other means (Patsy, 2012a).

Other bodies that impact on the development and delivery of energy policy include:

- The *Carbon Trust* stimulates and supports energy efficiency in business and supports low-carbon technological deployment;
- The *Energy Saving Trust* is government funded to stimulate energy efficiency and renewable energy take-up in the housing sector;
- The *Environment Agency* applies the Integrated Pollution Prevention Control regulations with major energy users and implements the EU Emissions Trading Scheme with energy generators and other large users.

Government intervention is not confined to the principles and objectives of energy policy. Instead, it covers a plethora of detailed policy initiatives delivered through Ofgem, the Carbon Trust, The Energy Saving Trust, the Environment Trust and the planning system (see for example the Energy National Policy Statements<sup>24</sup>). These initiatives are not the prerogative only of a strategy framework but extend also to the planning system.

## **1.3.2. Transport**

### **1.3.2.1. Transport Risk**

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advice from national authorities in regard to carbon budgets, progress reducing emissions and adaptation.

<sup>23</sup> For more information see: <http://www.decc.gov.uk> – Regulation of GB Energy Market.

<sup>24</sup> There are 6 Energy NPSs covering the following issues: overarching energy; renewable energy; fossil fuels; oil and gas supply and storage; electricity networks; and nuclear power. They are produced by DECC and receive designation by the Secretary of State for Energy and Climate Change.

Underinvestment, under-maintenance, and a growing population within the road and air sector, coupled with inappropriate resource diversion and inefficiencies within the rail sector define the current transport challenges. Growing demand on existing connections and dense concentrations at certain times of the day are putting the system under serious strain. The most heavily used and economically significant parts of the transportation network—urban areas; inter-urban corridors, and key international gateways—are showing signs of increasing congestion, unreliability, and overcrowding.

At the same time, environmental costs demand a different policy context for a transportation sector that needs to contribute to reductions in the UK's overall greenhouse gas emissions.

The most important type of transport infrastructure is the road network (Crafts, 2009, DfT, 2008). The UK road network is the dominant means of transport, providing 73 per cent of passenger travel and 65 per cent of freight moved (Eddington, 2006).

There are problems of severe congestion on urban roads: 89 per cent of transportation delay is estimated to be on urban roads (Eddington, 2006). The Department for Transport (DfT) forecasts suggest that congestion across the English road network as a whole will increase from 2003 levels by 27 per cent by 2025 and 54 per cent by 2035 (Department of Transport 2012b). Congestion is among the worst in Europe and reflects inadequate investment over previous decades (OECD, 2005). Furthermore, as with the aviation sector, there will be a need to reduce carbon intensity. In addition, improvement and maintenance costs are increasing. Road charging has been proposed as a long-term solution to the problem of road investment, maintenance, and finance (See Section 4.2.2. and Appendix A).

Current challenges of UK rail include unreliability (train punctuality is worse than the rest of Europe); the need to reduce carbon intensity (HM Treasury, 2011, Eddington, 2006); and increasing passenger crowding of commuter and intercity routes in the South East and in the London Underground at peak times. There is also widespread recognition that the rail industry has major problems in terms of low efficiency and high costs<sup>25</sup>.

The challenges facing the aviation sector include: reliability issues and constrained airport capacity, particularly hub runway capacity. UK international gateways have some of the highest levels of delay in the EU: 28 per cent of Heathrow flights and 24 per cent of Gatwick flights are delayed for over 15 minutes (Eddington, 2006). The two

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<sup>25</sup> The McNulty “Value for Money” report (2011) on railway costs confirmed signs of an efficiency gap. The higher costs are largely related to the relatively lower level of train utilisation in the UK. GB rail costs would need to be reduced by around 40 per cent to match comparable costs in France, the Netherlands, Sweden, and Switzerland. Passenger fares per passenger-kilometre on average are around 30 per cent higher in Great Britain and, although it is difficult to compare government funding streams in different countries, it is likely that the UK taxpayer is also paying at least 30 per cent more than taxpayers elsewhere. One reason for this is the excessive fragmentation between Network Rail, train operators, and their suppliers or contractors. The effects of fragmentation are exacerbated by misaligned planning and budgeting cycles between the various players and by having, in effect two separate regulators—the Office of Rail Regulation and the Department of Transport.

busiest UK airports are Heathrow and Gatwick. Heathrow operates at near full capacity as it relates to runway utilization and terminal passenger capacity. Gatwick operates at near full runway utilization, but has some spare terminal capacity. Despite recent efforts to alleviate constrained terminal capacity (such as the £2.3 billion investment in building Terminal 2, which is set to open in 2014), additional runway capacity is still required in many UK airports..

### **1.3.2.2. Current Institutional Architecture**

#### *Rail*

In a recent report sponsored by the DfT and the Office of Rail Regulation (ORR), Sir Roy McNulty concluded that inefficiency in the rail industry was largely due to structural fragmentation, manner of operation and culture among major players, incentives, legal and contractual frameworks, that characterise the rail industry (McNulty, 2011).

After privatisation in 1993, British Rail was divided into two components: the national rail infrastructure (comprised of track, signalling, bridges, tunnels, stations and depots) and the train operating companies (TOCs) that run on that network.

The former is owned by Network Rail (NR) which is regulated by the ORR and operates under a price-cap regulation. While the TOCs (both passenger and freight) run the trains, the actual train is often leased from a rolling stock company (ROSCO). The network operator owns the railway stations, most of which are leased to the TOC that is the main user of that station. However, Network Rail is primarily responsible for operating the main passenger terminals.

The DfT is charged with passenger and train related matters. In particular, the Secretary of State for Transport is responsible for determining the rail budget; setting the strategy; and letting the passenger rail franchises.

Contrary to expectations at the time of privatisation, the level of Government support for the rail industry has increased so that it now contributes around 40 per cent of industry total revenues. The remaining 60 per cent of revenues in the rail industry currently come from fare box revenues, a share of which NR receives in the form of track access charges paid by train operators (Smith et al., 2011). As a consequence of the level of subsidy, Government plays an important role in relation to investment plans.

Under the new funding structure, every 5 years the Government publishes two documents prior to the start of a periodic review of Network Rail outputs and funding: a High Level Output Specification of the outputs it wishes to see delivered in the forthcoming control period and a Statement of Funds Available (Smith, 2009).

## *Roads*

The DfT retains overall responsibility for strategy, policy and funding of the UK roads system. The Highways Agency is the executive agency of DfT responsible for the maintenance, operation and enhancement of the strategic road network on behalf of the Secretary of State. Maintenance and investment in the remainder of the network is the responsibility of local authorities (county councils and unitary authorities).

There is currently a lack of long term strategic thinking for the road network by the sector's governing bodies (Glaister, 2010). Whilst the Government has established a systematic process of five year plans for railways with an associated funding commitment (and private water companies are obligated to plan 25 years in advance), there is nothing comparable for roads. Glaister (2010) argues that this means Government may effectively have committed long term funding to rail projects with relatively low benefit to cost ratio over a period when budgetary pressures could lead to cuts in the roads programme, crowding out investments that could potentially offer higher returns.

## *Aviation*

In 1986, the Airports Act dissolved the British Airports Authority and redistributed the organization's property, rights, and liabilities to a new company, BAA. The company (since renamed Heathrow Airport Holdings Limited) is currently owned by FGP TopCo Limited, an international consortium of companies, pension funds, and sovereign wealth funds, led by Spanish construction firm, Ferrovial (Butcher, 2012).

The UK's independent aviation sector regulator, the Civil Aviation Authority (CAA) is responsible for the price regulation of Heathrow, Gatwick and Stansted airports and the consumer regulation of UK airports, which includes Aberdeen, Glasgow and Southampton airports. The Competition Commission is the competition regulator, but is also involved in price control determinations for the three London airports.

### **1.3.3. Other areas**

#### **1.3.3.1. Housing**

The under-supply of housing, especially in high-growth areas of the country has pushed up house prices (Barker, 2004). The UK has been incapable of building enough houses to keep up with growing demand. Many of the long-term issues of strategic planning and delivery that this paper highlights apply equally to housing investment even though most of the investment is undertaken by private business (see Section 3.2.3.)

### 1.3.3.2. Broadband

In comparison to other countries, the UK ranks very well in terms of broadband penetration (subscriber per 100 inhabitants) and price per megabit. However, the UK does poorly in other areas such as regional differences in broadband access, broadband technology – owing to the low penetration of fibre optic<sup>26</sup> and wired broadband subscriptions – and low broadband speed.

In particular the OECD has ranked the UK 8th in its latest Q4-2011 fixed wired broadband rankings, with 33.3 subscribers per 100 inhabitants, which compares well with the OECD average of 25.6. Bottom was Turkey with a score of just 10.4 (OECD, 2012a).

In terms of technology, 55.8 per cent of fixed broadband connections in the OECD came from DSL (e.g. ADSL) services, 30 per cent from cable (e.g. Virgin Media) and 13.7 per cent from fibre optic (FTTH / B / P). The UK remains dominated by DSL connections, has a low but increasing cable connection (that allow the diffusion of super-fast broadband) and has practically no fibre optic (OECD, 2012a). Looking at the wireless broadband diffusion among OECD countries, UK is middle ranked with just more than 50 subscriptions per 100 inhabitants. Korea, Sweden and Finland lead the OECD classification with (on average) more than 90 subscriptions per 100 inhabitants (OECD, 2012b).

In September 2011, the average advertised broadband download speed (i.e. not real-world performance) within the OECD countries was 41,009Kbps (41Mbps), which falls to 34,443Kbps (34.4Mbps) for the UK.

The UK is quickly improving in terms of the super-fast broadband penetration and download speed. OFCOM (2012) found that 10 per cent of all UK connections had fixed broadband speeds of less than 2Mbit/s in 2012, a significant improvement in comparison to the 14 per cent recorded last year. Superfast broadband (SFBB) is now available from commercial providers to 65 per cent of UK premises - a consistent increase from the 46 per cent in 2010 (OFCOM, 2012).

Finally, data on internet utilisation in the UK economy show very high penetration in household and businesses activities. Compared with other OECD economies, UK households tend to spend more time online to order or purchase goods and services (UK is ranked first among OECD countries with more than 60 per cent of individuals involved in these activities, versus 32 per cent of the OECD average), to play/download games, music or films, to engage in social networking, to communicate, to search for a job, or to use banking services. However, internet utilisation for learning and obtaining information from the public authorities' website is well below the OECD average. The

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<sup>26</sup> Although the cable connections is increasing.

Internet also play a critical role for UK businesses ranked among the top OECD countries in term of broadband connection, selling/purchasing activities over the internet, e-commerce share of their total revenue, having a website, share of employed persons using an internet-connected computer and completed forms returned to public authorities. Finally, looking at the economy in general, the value added generated by internet-related activities represents a larger share of GDP than in almost any other country (OECD, 2012b).

## **2. Causes of Underinvestment: Risk and Bias**

Infrastructure suffers from a series of market failures that impede the optimal level of investment from being reached<sup>27</sup>. What usually sets investment in infrastructure apart from other types of investment is its long-term, capital intensive nature - it typically generates long-lived assets with high sunk costs. This creates a gulf between (short term) marginal and (long term) average costs, which in turn, creates a time-inconsistency problem. This is particularly severe in the UK as unlike most other countries, the majority of UK infrastructure is owned and operated by the private, rather than the public sector. Indeed, private investors will be prepared to put their money into projects only if future customers agree, through a long-term contract, to buy the output at average cost and refrain from behaving opportunistically if a better offer subsequently comes along. Problems of credible commitment lie at the heart of the appropriate regulatory design of infrastructure policy (Jamison et al., 2005).

The need for such a long-term contract is made more pressing by the possibility of technological change leading to obsolescence, which increases fear among potential private investors that an adequate return will not be made on investments<sup>28</sup>. This can be achieved only if investors have a monopoly or if governments, through regulators, guarantee that future costumers will pay a price that reflects average costs.

Government intervention is also often required to allow for both positive and negative externalities associated with infrastructure projects – e.g. environmental considerations are an increasingly important factor in infrastructure investment decisions.

Historically, attempts to overcome market failures in infrastructure investment have led to state ownership and/or regulatory intervention. This, in turn, has exposed infrastructure investment to important (policy) risks and (decision-making) biases.

Problems of underinvestment in infrastructure are strongly related to these risks and biases, resulting in policy uncertainty, complexity and the lack of a holistic strategy that damage investment prospects, mainly in the energy and transport sector (CBI, 2012a).

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<sup>27</sup> See for example Romani, Stern and Zenghelis (2011) in for description of classical market failures in infrastructure investment.

<sup>28</sup> In almost all major network systems this is a real threat. In electricity, smart grids and meters threaten existing assets. In communications, copper wires face threats from new transmission mechanisms, including wireless ones. For nuclear and wind technologies, over the next decade or two, both may face new cheaper rivals.

## 2.1. Political Risk

In attempting to correct various forms of market failure, governments may regulate private service providers (through concessions, public private partnerships, or fully privately-owned companies) or provide the service themselves (as a public monopoly). In the first case (which covers the majority of UK infrastructures), governments make choices about types of infrastructure they are prepared to support through long-term contracts, they facilitate planning and licensing, and seek to create a regulatory environment that offers credible commitments to prospective investors (Helm, 2010a).

Private infrastructure investment, thus, relies on a political stamp - the State is the ultimate guarantor of the regulatory contracts that allow investors to make a return on their assets. The State also controls the planning system, which means prospective investors have to engage in the political process right from the outset.

The influence of state intervention on the infrastructure investment climate, in turn, brings with it risks that may lead to underinvestment and/or increases in the costs of capital. Customers of regulated utilities are also voters, potentially with an incentive to lobby politicians to renege on sunk costs (Helm, 2010a). Moreover, when public subsidies are involved, infrastructure investments might be exposed to shortsighted political behavior and short-term political expediency<sup>29</sup>.

It is not enough for governments to set out policy statements. There need to be institutional mechanisms in place capable of delivering sustainable policy commitments. Some countries have gone beyond creating policy statements and have created institutional mechanisms to deliver sustainable policy commitments. For example, the Nordics have achieved this through political systems that revolve around a culture that prioritises consensus. Others, like the UK, where the political system is much more adversarial in its nature, lack the institutional arrangement to achieve the same goal of cross-party consensus that support stable tax, regulatory and planning investment environments.

Sectoral bodies reveal the potential for advisory bodies to provide independent, expert advice on infrastructure issues within a clearly defined framework. Infrastructure Australia, for example, advises Australian governments, investors and infrastructure owners on a wide range of issues such as the country's current and future infrastructure needs with a focus on the modernisation of nation's economic infrastructure; mechanisms for financing infrastructure investments and unlock infrastructure bottlenecks; and policy, pricing and regulation issues and their impacts on investment and operation of national infrastructure networks. Moreover it conducts audits to determine the adequacy, capacity and condition of nationally significant infrastructure,

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<sup>29</sup> For example, land transport infrastructure (road and rail) has an economic life of over 30 years. The 10-20 year capital planning and budgeting cycle is incompatible with 7-year business cycles, 3-5 year political cycles and 2-3 year budgetary cycles (OECD, 2007a).

taking into account forecast growth. Their key analysis is subject to the independent assessment on the integrity and robustness of the processes that had been adopted by the Australian National Audit Office (ANAO). Infrastructure Australia also reviews and provides advice on proposals to facilitate the harmonisation of policies, and laws, relating to development of, and investment in, infrastructure; and identifies any impediments to investment in nationally significant infrastructure and strategies to remove those impediments. Infrastructure Australia reports regularly to the Council of Australian Governments through the Federal Minister for Infrastructure and Transport<sup>30</sup>. The composition of Infrastructure Australia reflects the close relationship among central, local government and businesses since all the 11 members are appointed by the Ministry from a pool of experts who have acquired the necessary knowledge or experience in the private sector or local government (Infrastructure Australia Act 2008, The Auditor General, 2011).

Examples of sectoral bodies that provide independent advice within the UK include: the National Institute for Health and Clinical Excellence, which has helped to create a better informed and less polarised debate around the choices of health treatments in the NHS<sup>31</sup>; the Migration Advisory Committee, which sets up the points-based system for immigration; the Low Pay Commission, advising on the minimum wage; the National Pay Review Bodies for public sector workers; and the Climate Change Committee. Although some government attempts to mitigate these problems, such as the introduction of National Policy Statements subject to parliamentary votes, the creation of the Infrastructure Planning Unit (already amended by the Localism Act 2011) and the creation of Infrastructure UK<sup>32</sup>, effective institutional arrangements seem to be absent in the UK. Some parts of the transport sector, for example, are known for involving a large number of players with a variety of different powers, responsibilities, and agendas. This has led to number of problems: (i) decisions driven by decision makers who have the largest influence (rather than those with the best solution); (ii) efficient options not being developed or considered; and (iii) the need to manage the needs of interlinked administrative units leading to extra costs and at times, gridlock, during the decision-making process (Eddington, 2006)<sup>33</sup>.

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<sup>30</sup> See <http://www.infrastructureaustralia.gov.au/about/>

<sup>31</sup> The government remains in charge of overall spending rules, but no longer directly manages difficult, detailed decisions where clinical expertise is of primary importance.

<sup>32</sup> Infrastructure UK (IUK) was introduced in 2010 with the role of providing advice on the UK's long-term infrastructure priorities and facilitating private sector investment over the longer term. IUK is a unit within the Treasury's Enterprise and Growth Directorate the Chief Executive is supported by a Non-Executive Chair – Paul Skinner – who chairs IUK's Advisory Council and made up of a group of Permanent Secretaries from the key infrastructure departments as well as senior representatives from the private sector.

<sup>33</sup> E.g. the use of Special Parliamentary Procedures (a further process that some orders of various types must undergo in Parliament by virtue of provisions in the Planning Act) has been criticised for creating an open-ended timeframe at the end of the planning process, so that businesses effectively have no guarantee as to when determination will take place (CBI, 2012c).

## **2.2. Analytical Risk**

Politics and economics interact in complex ways, exerting powerful influences over each other (Stern, 2010). For infrastructure investments, these interactions represent an additional source of risk – one more possible threat to the clarity and stability of the investment environment.

The last century witnessed a number of changes in political perspectives that have played influential roles in steering the evolution of public economics<sup>34</sup>. For example, a “pro-market” era of government retreat and deregulation (from the 1970s onwards) replaced an era where government took an active role in the economy through increasing taxation and public expenditure (after WWII). While there were sound economic arguments for the privatisation and regulation of coal, oil, car, and steel industries, the benefits of rail privatisation and regulation were less well defined, and it required much greater care than that the UK experience relied on.

In that period, and partially as a reflection of that experience, public economics has been marked by an ‘ideological’ approach based on the presumption that ‘markets know best’ on both the micro and macro fronts. This approach, rather than one that allows the possibility of improvements through reform<sup>35</sup>, has had too much influence in determining the financial deregulation in rich countries, the infrastructure and pension policy in developing countries, and the process of transition in Eastern Europe and the former Soviet Union.

By the same token that politics influences economic policy, economists also influence political decisions. Changes in economic orthodoxy can have a profound impact on the direction of policy. For example, measuring the net impact of green growth policies requires allowing for distortions originating in market and government failures. Standard models based on “first-best” assumptions can usefully assess benchmark costs of these policies, but are unable to investigate the full benefits, such as changes to incentives to innovate (e.g. Aghion et al. 2012). Shifting to cost-benefit analysis that takes these externalities into account has had real consequences on policy decisions and investment opportunities.

## **2.3. Policy bias**

### **2.3.1. The Evaluation Process: Cost-Benefit Analysis**

From project conception to delivery, first-rate evaluation is necessary along the infrastructure pipeline to make sensible decisions in the best interest of current and future generations (Henckel and McKibbin, 2010). Independent, rigorous evaluation of policy alternatives is an important component of well-informed political debates,

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<sup>34</sup> See Stern (2010, pg. 255-257) for a thorough description of the historical link between policy and economics.

<sup>35</sup> A canonical statement of this is in the work of James Meade. As Stern (2010) notes, the Meadean tradition frames policy design within the context of imperfect economies.

capable of gathering broad, cross-party consensuses and underpinning stable, long-term policy orientations.

In practice, evaluation of policy alternatives in government suffers from a number of important weaknesses. Although the existing evidence is limited, it suggests project appraisal is often exposed to strategic overestimation of benefits and underestimation of costs (e.g. Ergas and Robson, 2009; Flyvbjerg, 2009). Most recently, the National Audit Office (NAO) has concluded that departments could either not demonstrate the value for money of government interventions or that interventions provided poor value for money due to an absence of option appraisals (NAO, 2011). The main weaknesses found included:

- Inadequate development of options against which to judge the preferred course of action;
- Lack of monetisation of burdens and benefits. Over 40 per cent of those involved in the appraisal process surveyed did not agree that sufficient time and effort went into monetising impacts;
- Unstructured qualitative analysis – while qualitative arguments were influential in a large proportion of cases, few followed guidance on ways to structure that analysis, or applied a qualitative structure consistently to all options considered.

In the same vein, in a recent review of 189 Impact Assessments, the Regulatory Policy Committee judged 44 per cent of appraisals not fit for purpose (Regulatory Policy Committee, 2011)

In interviews given to the NAO, Chief Economists “have acknowledged that departments often consider a narrow range of options and noted that promising options are often dismissed too early or discarded options not revisited when a change in scope would again make them viable. They explained that a lack of option development is common in circumstances where ministerial decisions have limited the number of practical solutions” (NAO, 2011, p.14).

The limitations of project evaluation are not confined to the idiosyncrasies of government, but rather extend to the instruments that analysts have at their disposal to conduct such evaluation. Cost-benefit analysis is the centre piece in the economist’s appraisal toolkit. It is often seen as a tried and tested methodology. It has a relatively well established body of theory underpinning it, as well as a long list of practical applications. Less well known and debated, however, are its limitations. Dynamic gains, costs and risks, for example, are not usually part of project evaluation. Analysis of important, but theoretically and empirically difficult social, environmental and economic impacts is often left behind (Romani et al., 2011).

A number of experiments are underway in OECD countries which warrant further exploration. These include the use of qualitative multi-criteria-analyses to complement

standard cost-benefit analysis; and models that compare ex-ante (i.e. during the decision phase) and ex-post (i.e. after the project completion) evaluations in order to determine whether the investment's targets have been met (this is a common practice at the World Bank and more recently at the European Commission) (Pellegrin and Sirtoni, 2012).

### **2.3.2. Limitations of the Planning System and Compensation Mechanisms**

Prior to 2008, the British planning process for applications to build nationally significant infrastructure was slow and complex. The consent procedure for major infrastructure projects required a public inquiry. Despite attempts to improve procedures, public inquiries remained notoriously long for controversial cases. For example, Heathrow's Terminal 5 experienced the longest public inquiry in UK planning history and ultimately took over 15 years for the terminal to be complete. This stood in marked contrast to France's Charles de Gaulle airport which constructed 4 runways and 5 terminals in 20 years (Corry et al., 2012).

Following the public inquiry, the inspector would make a recommendation to the Secretary of State. The Secretary of State genuinely had the last word, and could reject the recommendation, provided that (s)he gave reasons. There was no provision for a parliamentary vote - the statements just had to be tabled. That meant that a subsequent government could simply reverse a policy by inserting the word 'not' for a specific project, leading to stranded sunk costs.

In an effort to address this problem, the *Planning Act 2008* created a two-tier planning system, thus bringing England and Wales in line with their European neighbours: smaller infrastructure projects and housing construction remained under the jurisdiction of local authorities and the National Planning Policy Framework. In contrast, national infrastructure projects were removed from the control of the Town and Country Planning system and placed within a streamlined national scheme, first under the Infrastructure Planning Commission, and now administered by the Planning Inspectorate—an Executive Agency of the Department of Communities and Local Government (DCLG) and the Welsh Government.<sup>36</sup>

The *Planning Act 2008* introduced new National Policy Statements (NPSs)<sup>37</sup> and provided for a new Infrastructure Planning Commission (IPC) to provide "development consent" for Nationally Significant Infrastructure Projects (NSIPs)<sup>38</sup>.

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<sup>36</sup> As described in the section on policy risk, some experts fear that the change imposed by the Planning Act 2008 increases the possibility of politicised or vote-motive lobbying because of the reintroduction of a ministerial decision-making role.

<sup>37</sup> The NPSs give explanations for each proposed policy contained in the statement, and include an explanation of how the policy relates to the mitigation of, and adaptation to, climate change. The 16 types of NSIPs specified are: electricity generating projects; overhead electric lines; underground gas storage; LNG facilities; gas reception facilities; gas pipelines; other pipelines; highways; airports; harbours; railways; rail freight interchanges; dams/reservoirs; water transfer facilities; waste water treatment plants and hazardous waste

The Secretary of State would no longer have the final word. Instead, the Government would publish a NPS covering that type of infrastructure. The IPC would take its decision largely on the basis of that NPS, using its time to consider points specific to the particular application. NPSs would be published in draft, for consultation and Parliamentary scrutiny by a report from a Select Committee and might increase the amount of policy continuity, by limiting the ability of policies to be changed with each new parliament.<sup>39</sup>

However, political pressures could still bleed through the planning process and affect the way in which decisions on NSIPs applications are made. The NPS were created within the current parliamentary framework, and were subject to a series of other legislative processes and government initiatives (in the form of other white papers and bills). Consequently, the remit of a particular NPS would be subject to the specificity of the Government. This, in turn, would influence how the IPC assessed NSIP applications.

Under the *Localism Act 2011*, the Coalition Government scrapped a significant part of the *2008 Act*. The IPC functions were transferred to a new National Infrastructure Directorate (NID) within the Planning Inspectorate<sup>40</sup> within the DCLG. While the Planning Inspectorate does not comment on Government policy, it continues to make recommendations within the framework provided by the NPSs. It retained the idea of the NPS in order to facilitate the development consent procedure for major infrastructure, and introduced the requirement of a vote in favour by Parliament before they are designated as NPSs by the Secretary of State (whose power to interfere with the process was unfortunately reinstated).

While the new system is still in its infancy, it does seem on paper to better balance national and local needs. The Planning Inspectorate has specified timeframe to work with: 3 months from the application being made to establish the process, 6 months to consider evidence, and 3 more months to make a recommendation. The Government then has 3 months to make a decision.

Despite the reforms and suggested timeframe, several factors contribute to the continued inefficiency of the planning process.

First, the British Planning system continues to rest on a process of “development control” where the supply of land for each legally defined use is controlled by the planning system. As a result, uses are themselves legally defined. Thus specific planning permission from the planning authority is required to convert land which is designated

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facilities.

<sup>38</sup>The Planning Regime applies to Nationally Significant Infrastructure Projects, which require a type of consent known as “development consent.”

<sup>39</sup> Given their infancy, the exact impact of the NPS in reducing policy risk is still unknown. Rosewell (2012) argues that the nuclear NPS is the only NPS that is being actively used. One argument against their widespread use is their lack of clarity.

<sup>40</sup> In England, the Planning Inspectorate examines applications for the energy, transport, waste, waste water and water sectors. In Wales, it examines applications for energy and harbour development, subject to detailed provisions in the Act; the remaining matters are under the remit of Welsh Ministers.

for agricultural use to housing use. This has led to an inefficient planning system characterized by discrete, stochastic decisions subject to appeal.

Second, there is concern that despite the intention of streamlining infrastructure applications, a “Special Parliamentary Procedure” (SPP) that has been retained in the Planning Act for certain types of land<sup>41</sup> could act in competition to the new Planning Inspectorate and more than double the decision time of affected projects, increasing uncertainty and damaging investor confidence (CBI, 2012c). In its 2012 Budget, the Government announced that it would remove duplication by adjusting the scope of the SPP.

And lastly, many infrastructure projects which fall below the threshold of a NSIP but are clearly part of the national infrastructure, such as rail depots and wind farms, remain under control of the local authorities. In a further attempt to streamline and simplify the planning process, the DCLG introduced the National Planning Policy Framework (NPPF) in 2012 for smaller infrastructure projects and housing construction<sup>42</sup>. Despite these reforms, English planning authorities following NPPF guidelines are quasi-political bodies operating on a District level, and are thus still vulnerable to pressure from local interests.

### **2.3.2.1. The Traditional Approach to Compensation—Communal Compensation**

There is a fundamental misalignment between the geographically concentrated costs and the benefits that accrue to a larger outside population associated with major infrastructure developments. This leads to further delays within the planning process.

The Thames Tideway project is a perfect example of infrastructure planning that has experienced delays due to a lack of recognition to the asymmetric benefits and costs of development. Though the Greater London Authority has supported the development on a London-wide basis, many of the borough councils along the proposed route have fought against the project due to local perception of the disruption caused during a five year construction phase.

There are various strategies that could be used in handling “potential losers,” such as citizens who will lose access to a desirable local environment and encounter lower property values due to the development of a nearby airport or rail line (Aldrich 2007). A classic non-coercive approach to the problem is a mechanism to attach compensation for potential losers, whether individual citizens are facing an incinerator in their backyard or corporations have to spend more to reduce emissions, in order to avert or

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<sup>41</sup> SPP applies to: open space land that was not being replaced; National Trust land; and land belonging to local authorities or statutory undertakers (i.e. utilities) where that body had objected to their land being taken.

<sup>42</sup> The guidance in the NPPF runs to just over 50 pages and replaces over 1,300 pages of guidance and policy contained in 44 separate documents.

reduce objection (Frey et al., 1996; O'Hare, 2010). For more detail on the theory of compensation, see the Appendix B.

In the UK, the traditional method of compensation for those affected by development has been one of communal compensation to larger communities.

This has been in the form of Planning Obligations under S106 of the Town and Country Planning Act 1990. Section 106 agreements were designed with the intention of ensuring that developers would contribute to the costs of developing local infrastructure, open space or affordable housing. Section 106 agreements have been criticised for being highly dependent on the skills of the negotiators and for causing lengthy delays due to the time to finalise agreements. Only 6 per cent of all planning permissions generated a contribution to local infrastructure. Since 2010, planning policy has marginalized Section 106 agreements in favour of other measures.

The *Planning Act 2008* introduced the *Community Infrastructure Levy* (CIL) as a charge by a local authority on developers and is intended to compensate local authorities for the additional costs which are attached to new development, and to incentivise councils to approve new developments. The money can be used to support development by funding infrastructure in the local interest. CIL is only charged on buildings to which the public generally have access. As of August 2012, there are 48 CIL charging authorities which have published CIL charging plans, with 6 of those authorities already charging the levy and a further three authorities due to commence charging by the end of the year.

CIL, like Section 106 agreements, provides funds for community services and thus does not fully address the asymmetric distribution of benefits and costs associated with development. It does not directly compensate local residents for the loss of asset value or amenity<sup>43</sup>. CIL focuses on compensating the local authority for the wider infrastructure costs but overlooks costs to the existing local population, who are the individuals who perceive themselves as having the most to lose from development and those likely to create political and legal obstacles to it. Moreover, as only developments which are regularly accessed by the public are liable to pay CIL, infrastructure such as wind turbines and sewage works are not liable to pay the levy and to therefore offer some community benefit.

In the current UK system, monetary compensation directed at individuals is widely viewed as inadequate. The *Land Compensation Act of 1973* is mainly limited to assessed market value for compulsory purchase (where compensation is paid at the open value of the property) and strictly to physical damage and major disturbance from public

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<sup>43</sup> This point was reiterated in a report by Policy Exchange which further highlighted that a major problem with CIL is that it misaligns incentives for developers, planners, and the local population: "Despite the size of these [community level] incentives, they did not spur enough building: the benefits were spread too thinly across the local authority as a whole, rather than concentrated on those who had been affected by development" (Morton 2011).

works (such as road building or airport construction), thus excluding house building and loss of value as a result of loss of access to open space or views. This feeds into a highly bureaucratic process in which compensation takes a long time to be settled and paid.<sup>44</sup>

### **2.3.2.2. International Examples of Successful Compensation**

A variety of schemes to determine and to pay monetary compensation have been put forward, including structured negotiations with a designated body that represents community-level interests; an auction of the facility to the site willing to accept the smallest compensation payment; further investment in infrastructure, medical facilities, or in-kind nature restoration; and lump-sum tax refunds.

There is support for the view that monetary compensation can be effective: in a review on compensation schemes for noxious facilities, economic incentives are found to be helpful for the cases of low or moderate risk sites such as waste landfill sites and prisons (Kunreuther and Easterling, 1996). O'Hare (1977) has stated that the failure in practice to convince locals to accept controversial infrastructure developments is a strategic problem resulting "from failure to pay compensation to neighbours who suffer costs."

On the other hand, several authors find that rather than monetary compensation, good relations with communities, involvement of community members, and persuasion skills are the most important. Based on survey data in Switzerland, Frey et al. (1996) find that residents consider health and safety as inherent rights that should never be traded and that generally, compensation schemes based solely on price incentives are rarely successful. Therefore, people do not increase their propensity to accept hazardous facilities even if economic incentives are offered. Moreover, pure money compensation has a disappointing track record at least in the context of facilities threatening health or injury risk.

The implication is that success in the face of opposition cannot be achieved by any single administrative device. A combination of monetary and non-monetary incentives will usually be needed in eliciting support (Carnes et al., 1983).

Compensation schemes from France and the Netherlands indicate that effective use of compensation techniques can shift attitudes and give residents and communities a stronger incentive to support development.

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<sup>44</sup> Planning lawyer, Carl Dyer—an acquaintance of Professor Cheshire who has been practicing planning law for over 30 years—recounts a case where such private subcontracting agents took the precaution of doing both a traffic count and an acoustic measurement before and after so were able to demonstrate there was no increase in noise levels. There were in fact very few claims made but they all were dismissed. Even when compensation is payable it is only at a level such as is necessary to install double glazing to mitigate the disturbance. In 30 years of practicing planning law, Mr. Dyer has never been involved in a successful claim—which hardly comes up in the first place.

The French planning system is widely regarded as more successful than the UK system for driving development. There are generous compensation schemes in France designed to provide incentives for residents affected by development. For example, in order to avoid delays and political conflict associated with the building of the Charles de Gaulle airport, the Minister of France authorized payments at four times the estimated market value for affected local residents who voluntarily sold their land. While the compensation is primarily provided at community level through levies on developers, the major difference between the UK and French planning systems is the closeness of the commune to local residents. French communes number 36,000, while England has just 326 local authority planning bodies. In France, communes are intimate enough to allow a series of developer-funded compensation schemes to make a difference in public attitudes, while in England local authorities are too large and the fruits of any developer payments too removed to generate the same effect.

Holland has the highest levels of population density in Europe and has been highlighted by the International Academic Association of Planning, Law and Property as having one of the most pro-development planning systems in the world. Cash compensation to individual residents is available to individuals affected by planning decisions. Such compensation is determined by independent experts at the moment planning is approved. Compensation is paid by the local authority, but in practice there are voluntary agreements with developers who reimburse the municipalities for these costs. With major infrastructure projects, it is the central government that is responsible for paying out the compensation.

### **2.3.2.3. On-going Efforts to Improve Compensation**

Recently, in the UK, there have been a number of positive initiatives that have moved compensation schemes closer to the best practice described in the previous section.

For example, across the construction sector it is normal practice for voluntary compensation mechanisms to be established by developers. Property Market Bond schemes have been advanced by BAA: local residents who will potentially be impacted are issued with bonds to the value of pre-development property prices. These will be redeemed by the developer in exchange for property if the property fails to sell on the open market.

Moreover, to accompany the development of High Speed 2 between London, the Midlands, and the north of England, the Department of Transport has stated compensation will be “significantly beyond statutory requirements.” As of October 2012, the compensation package is valued at £1.3bn (more details in Box A).

<b>Box A: High Speed 2 Compensation</b>
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The Property and Compensation Consultation of HS2 between London and the West Midlands have put forward a series of proposals:

- A system of advanced and voluntary purchase to provide greater ease and certainty for those in and immediately outside the safeguarded area.
- A sale and rent back scheme to allow homeowners whose property will need to be demolished to sell their homes, but remain living in them up until the accompanying land is required.
- A hardship scheme to help those outside the safeguarded area and the voluntary purchase zone who need to move during the development of HS2, but are unable to sell their home.
- A series of schemes aimed at maintaining confidence in properties above tunnels; and
- A framework for working with local stakeholders to design a strategy to replace any social rented housing which is lost in the process.

Source: Department of Transport (2012a)

### **2.3.3. Public Accounting**

*Public Sector Net Debt* (PSND) is one of the key public sector finance statistics used by the Treasury to manage and monitor fiscal policy and by the Office of Budget Responsibility (OBR) to forecast and evaluate the path of public finances<sup>45</sup>. It is based on information reported in the UK National Accounts (NA), produced by the Office of National Statistics (ONS) following an accrual accounting basis.

PSND measures how much the UK public sector owes at a given point in time. When Government borrows money - or increases its financial liabilities through other channels - it raises its debt level. Net debt, for the purposes of UK fiscal policy, is defined as total gross financial liabilities less liquid financial assets. Liquid assets include cash and short term assets which can be converted in cash at short notice and without significant loss. They mainly comprise foreign exchange reserves and bank deposits. Since the NA measure only financial liabilities and liquid assets, tangible and intangible assets are not included. In the NA, net additions of fixed assets are treated as capital spending and contribute to Public Sector Net Borrowing- the difference between total accrued expenditure (both current and capital) and total accrued revenue (or receipts).

PSND does not distinguish between economic stimuli which increase consumption and debt liabilities and those that increase productive investment and add (or prevent the depreciation of) assets to balance the liabilities issued. As a result, if Government

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<sup>45</sup> Another measure used by the current Government for its fiscal policy is the Surplus on Current Budget, i.e. a measure of the amount by which current receipts are greater than current expenditure after allowing for depreciation.

created assets that improved growth and generated higher value than debt, it would improve the public sector balance sheet but would not reduce PSND. This emphasis on debt - without adequately accounting for assets - imposes constraints on rational decision making (Newbery, 2010). The failure to use proper public accounting methods makes public investment – for example, in road maintenance – look artificially expensive and hampers good decision-making. It is like judging a firm solely on the profit and loss account while ignoring the balance sheet.

Positive steps in the direction of adequately accounting for the value of assets have been taken through the development of Whole of Government Accounts (WGA): a consolidated set of financial statements for the UK public sector<sup>46</sup>. WGA is based on EU adopted International Financial Reporting Standards (IFRS), the system of accounts used internationally by the private sector and adapted for the public sector context<sup>47</sup>. The closest equivalent to PSND in the WGA is the so-called Net Balance Sheet Position. The latter is a broader measure of the public sector's balance sheet, including a wider range of both assets (fixed assets and all financial assets) and liabilities (Daffin and Hobbs, 2011; OBR, 2012).

To date, the WGAs have not been used as the basis of fiscal policy targets.

### **3. Core Policy Recommendations<sup>48</sup>**

#### **3.1. Core Recommendations on Infrastructure**

The persistent failure of infrastructure policy in the UK requires a new approach. Our main proposal is for a new architecture to govern infrastructure strategy, delivery and finance that would facilitate long-term planning and reduce policy instability in those critical areas. .

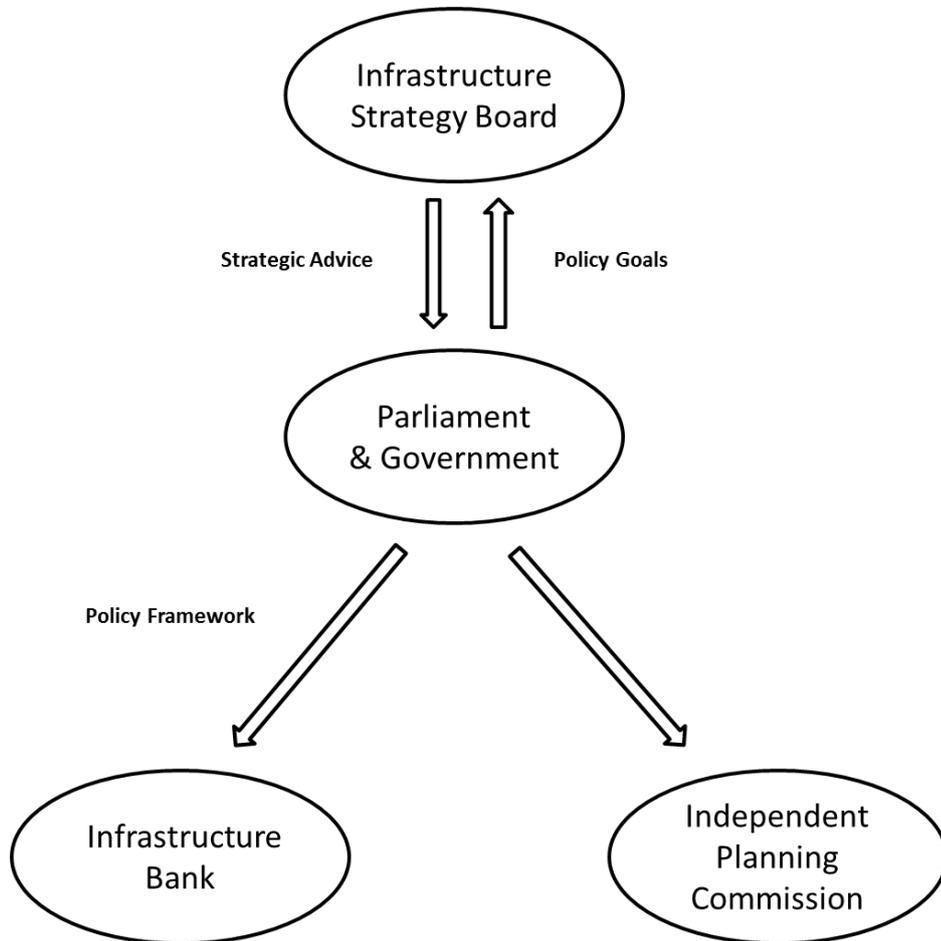
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<sup>46</sup>The WGA covers the financial statements of central government departments, local authorities, devolved administrations, the health service, academies and public corporations. However, not all government bodies take part to the WGA. In particular *Network Rail*, further education colleges, *some Academies*, some local authority school buildings, the fully-Treasury owned banks (such as RBS) are not included. The Bank of England and the Bank of England Asset Purchase Facility Fund have been included in the .2010-11 WGA but were excluded from the 2009-10 one. All PFI projects, which are required under accounting standards to be recognised in the account, are included in the WGA (NAO FAQs, 2012, Morse, 2011). In terms of its content, the WGA doesn't include everything that accounting standards require, and this is a concern voiced by the Comptroller and Auditor General.

<sup>47</sup> See Morse (2011) for an international comparison of WGA-similar accounts.

<sup>48</sup> The recommendations reflect the views of the Commissioners and can also be found in the Growth Commission Report.

*Figure B: The New Institutional Architecture for Infrastructure*



Our proposal has three core institutions:

- An Infrastructure Strategy Board (ISB) to provide the strategic vision in all areas: its key function would be to provide independent expert advice on infrastructure issues. It would lay the foundation for a well-informed, cross-party consensus to underpin stable long-term policy. The ISB would support evidence-gathering from experts and operate thorough, transparent and wide-ranging public consultations, engaging interested parties and members of the public in the debate over the costs and benefits of policy options. The ISB would obtain its authority from and be accountable to parliament. Its mandate would be laid down by statute. As a standing body, it would produce regular reports on infrastructure needs and long-term priorities and challenges. The ISB would be governed by a high profile, independent management board, which would be

directly accountable to and appointed by parliament. An *Infrastructure Planning Commission* (IPC), which would be charged with delivering on the ISB's strategic priorities. This body existed in the recent past. It has now been replaced by the Infrastructure Planning Unit under the auspices of the Department for Communities and Local Government. This change reintroduced ministerial approval for projects and we believe that independence from ministerial decision-making should be restored. The IPC is designed to give predictability and effectiveness to (mostly private) investment that drives implementation of strategy. It must not be misunderstood as a 'central planner'.

- An *Infrastructure Bank* (IB) to facilitate the provision of stable, long-term, predictable, mostly private sector finance for infrastructure. There are good theoretical reasons for the creation of such a bank: it can help to overcome key market failures in capital markets in a direct and constructive way. In particular, it can help to reduce policy risk and, through partnerships, to structure finance in a way that mitigates and shares risk efficiently. This will require a whole range of financial instruments including equity and structured guarantees. There are good practical examples that show the advantages of a bank with this sort of mandate, such as Brazil's BNDES, Germany's KfW, and the European Bank for Reconstruction and Development and to some extent the European Investment Bank. The IB would develop banking and sector-specific skills in new and important areas. It would use its special ability to make investments that could then provide powerful examples with catalytic effects on private investment through its partnerships. It could have a very strong multiplicative impact so that its investments have effects much larger than the amount of capital it puts in. The IB would be governed by an independent board with a clearly defined mandate and access to capital markets. Further details are available at <http://www2.lse.ac.uk/researchAndExpertise/units/growthCommission/documents/pdf/SecretariatPapers/BInfrastructure.pdf>.
- We need to institute *generous compensation schemes* to extend the benefits of infrastructure projects to those who might otherwise stand to lose, either due to disruption caused by the construction phase or by the long-term impact on land and/or property values. The principle is to share the broad value that the implementation of the national strategy will bring. Such compensation schemes should be enshrined in law and built into the thinking of the ISB and the operations of the IPC. At present, the UK does not provide adequate compensation for individuals who bear the costs of development. This contrasts with other countries, where mandatory compensation due, for example, to noise, travel or other disruptions is commonplace. The UK's problem arises partly because the level of compensation is low and partly because existing compensation schemes are primarily communal. Both communal and individual schemes are necessary.

Our proposed infrastructure institutions would facilitate long-term planning and reduce

policy instability in the planning, delivery and financing of an infrastructure strategy for the UK. The new institutional architecture would allow government to choose its priorities and decide on strategy. But crucially, it would ensure that political decisions are taken in the right place; that they do not expand to aspects of strategy and/or implementation where they add little value and can be a costly source of instability (for example, planning); and that they represent credible commitments for current and prospective investors. In addition, the new framework would support a political debate informed by rigorous, independent assessment of policy alternatives, fostering the formation of cross-party consensus where possible, making political procrastination harder and thus generally improving the quality of policy-making.

The projects considered by the Infrastructure Strategy Board, delivered by the Infrastructure Planning Commission and financed by the Infrastructure Bank would be those of greatest national priority, such as ones in roads, aviation and energy. But the programme of work could also be responsive to large-scale regional project infrastructure proposals from outside parliament. For example, local enterprise partnerships (collaborations of businesses, local authorities and other groups in an economically meaningful unit) may put together a bid for building a cluster of science parks, which would involve many outlays on transport, buildings, and energy and telecoms supplies.

Allowing such sub-national bids would ensure a more bottom-up approach to major regional projects that involve strategic thinking. This would help to use more local initiative and decentralised information than would be available at a national level. The abolition of Regional Development Agencies and regional offices has left a strategic planning vacuum between the national level and the very micro-level (districts). Indeed, the institutions that support regional economic development in England are a classic example of policy instability, being the subject of numerous reforms, often with radical policy swings following national elections.

*An example of how our infrastructure proposals would help the impasse over the shortfall in runway capacity in the South East.*

The Infrastructure Strategy Board would be a permanent, dedicated source of independent and analytically robust advice that would help to align political views. If it had existed now, it would have avoided the need to set up the Davies Commission to investigate the problem again from scratch. The expansion of Heathrow has already been discussed by numerous other inquiries (for example, the 1968 Roskill Commission). Rigorous information about the costs and benefits of different policy options would have been available from a team of experts long immersed in the strengths and weaknesses of the existing evidence.

The Infrastructure Planning Commission would operate under the rules defined by

National Policy Statements like those currently used. It would ensure that planning is not used to re-open political debates each step of the way while implementing policy. The Infrastructure Planning Commission would deal with the ensuing planning practicalities, namely reviewing and deciding on specific applications for development consent. It would also decide about compensating those who stood to lose from the expansion of an existing airport or the building of new one, following a set of clear rules enshrined in law. This would help to mitigate political bickering and deliver transparent and predictable planning decisions.

## **3.2. Other Areas to Support Infrastructure**

### **3.2.1. Public Sector Accounts**

Public investment should not be hamstrung by accounting methods that impede a focus on economic returns. Therefore, for fiscal targets to be useful as a strategic management tool, they should incorporate the value of public sector assets rather than concentrating solely on public sector debt. Otherwise there is no distinction between extra borrowing to finance consumption and borrowing to finance investment in new assets or in repairing the condition of existing assets. The failure to use proper public accounting methods makes public investment – for example, in road maintenance – look artificially expensive and hampers good decision-making. It is like judging a firm solely on the profit and loss account while ignoring the balance sheet. The UK is leading efforts in improving public sector accounts (for example, through the publication of *Whole of Government Accounts*). It is time for government to use these new accounts as the basis for policy-making.

### **3.2.2. Road Pricing**

Road pricing is an idea whose time has come. There are no major technological impediments to a system that would manage congestion, be fairer and improve incentives for building and maintenance. To the extent that there are political impediments with moving to comprehensive road pricing, these can be overcome in the longer term. A new regulator should administer the system following a regulatory asset base model, an approach that has proved to be successful in other areas of infrastructure. By creating dedicated revenue streams, this would help to provide a long-term solution to the problem of road investment, maintenance and finance. Road pricing could be made attractive to the electorate by accompanying its introduction with a cut in fuel duty as a large component of the tax is currently rationalised by the need to limit congestion. In some circumstances, national roads (operated by the Highways Agency) could be auctioned off and shadow tolls introduced in this section of the road network.

### 3.2.3. Housing

The ISB and IPC should also take responsibility for long-term strategy and delivery of housing throughout the UK where this is naturally complementary with infrastructure goals. Schemes to increase the amount of land available for development need to overcome local resistance. Institutionalising a flexible system of compensation for those who stand to lose from new developments is important, for example, via funding local amenities, reductions in council tax payments or straightforward cash. Appropriately generous compensation schemes should, in particular, help to diminish local opposition to development.

### 3.2.4. Broadband

With regards to telecoms, **broadband** plays an increasingly important role in connectivity. But the UK's broadband infrastructure is not outstanding compared with other countries. The UK ranks typically in the middle of the table in terms of raw broadband performance and deployment, including broadband speed and network coverage. But compared with other advanced economies, we tend to spend more time online, buy more online and the value added generated by internet-related activities represents a larger share of GDP than in almost any other country (OECD, 2012b). To continue taking advantage of the extraordinary opportunities that the internet offers, we must continue to be prepared to respond flexibly and promptly to a rapidly changing technological environment. Again, the institutional architecture we propose could help with problems here as they arise.

## Appendix A: Road Pricing

There is evidence to suggest that the gradual introduction of a road regulator to administer a regulatory asset base model in the road sector to provide a long-term solution to the problem of road investment, maintenance and finance (e.g. Glaister 2010).

Several academics argue that the regulatory model that works well for privatized profitable networks, which has led to significant improvements in efficiency, investment levels, and quality, would work well for the public, but potentially profitable road network. This regulatory regime sets price limits based on periodic reviews of investment requirements, efficiency, and outputs (Glaister 2010, Helm et al. 2009). Consequently, customer interests are protected and companies—who must operate under a licence, which defines a range of supply and conduct requirements—are forced to ensure their ability to properly finance their functions.

In a series of recommendations for generating long-term funding, Glaister (2010) recommends generating a regulated private utility with shadow tolls or with direct road user charges. Unlike in France, Italy, and other countries, direct charges are limited to the M6 Toll Road north of Birmingham and several bridges in the UK. Currently some English roads, such as the M40, are provided and maintained under a system of shadow tolls, where a private contractor receives payment from government based on the extent of utilisation. This goes unseen by the road users and so does not influence their behavior.

Crafts (2009) argues that road pricing is potentially a more efficient solution to combating road congestion than a large road building programme and tolling portions of the existing road network could deliver increases in productivity for the transport-using sector. The Eddington Report (2006) note that resources need to be directed towards improving the performance of the existing network since the UK is already well-connected. Benefits of increasing the usage of road pricing schemes include: spreading demand, minimizing congestion and overcrowding, improving reliability and delivering benefits to the wider economy. A road pricing scheme that varies costs according to location and time of day would be an improvement to the duty on full use in reflecting the full societal costs of transportation and could generate benefits up to £28bn by 2025 (based on a modelling work within the Report). The Eddington Report (2006) cites the area-based congestion charging scheme in central London as an example of a success: since its introduction in 2003, Transport for London estimates that traffic levels within the charging zone have decreased by 15 per cent, congestion levels have fallen by 26 per cent, and average traffic within the zone has increased by an estimated 2 km/hr.

## **Appendix B: Theory of Compensation**

The traditional economic view posits that opposition by local residents rests on a misalignment between geographically concentrated costs and benefits that are distributed to a larger outside population. Several price-based compensation schemes have been developed to deal with appropriately redistributing the aggregate net benefits to ensure that the host communities receive positive net benefits.

In reality, however, compensation schemes based purely on price incentives have seen mixed results. Authors argue that the traditional economic theory of compensation is incomplete in important aspects because it neglects the influence of moral principles. In the sphere of politics, where planning battles are typically fought, such moral considerations dampen the effects of price incentives (Frey et al. 1996).

### *Designing schemes to share the benefits*

Roughly speaking, there are two strands of empirical research in this area (Coursey and Kim, 1997).

The first strand of research emphasizes the importance of psychological and communicational factors rather than of compensation for the loss caused by a policy that creates losers and winners. An extreme in this strand is the Crowding-out Theory which argues that offering financial incentives for hosting a hazardous site reduces citizens' willingness to permit the construction a noxious facility.

The second strand concerns how to apply and design compensation schemes (Kunreuther et al., 1987; Sullivan, 1992; Richardson and Kunreuther, 1993; Kleindorfer and Sertel, 1994). For example, the 2006 UNEP Compensation Policy Issue examined compensation schemes for dams, and classified them into four main categories: (i) monetary compensation for lost assets and loss of access to resources; (ii) livelihood restoration and enhancement; (iii) community development (which includes local infrastructure and financing development); and (iv) nearby nature development.

A variety of schemes to spread the benefits of development have been proposed, including: structured negotiations with a designated community body; an auction of the facility to an area willing to accept the smallest compensation payment; further investment in infrastructure; lump-sum tax refunds; and conditional guarantees, such as property value insurance (O'Hare et al., 1983; Kunreuther and Kleindorfer, 1986; Deshpande and Elmendorf, 2008). Compensation in the form of property value insurance may be offered to individuals affected by the construction of a transportation link, such as a highway or rail line: a homeowner displaced by noise can avoid any financial losses that occur should his home suffer a loss in property value.

O'Hare (2010) writes that a sincere and credible attempt to compensate affected individuals when they accommodate a socially beneficial project is a necessary beginning, though not the end, of local opposition conflict resolution.

### *Effectiveness*

Existing empirical evidence is conflicted as to whether or not compensation has countered opposition in these developments (White and Ratick, 1989; Frey et al., 1996; Jenkins et al., 2004; Gallagher et al., 2008):

Several authors find that good relations with communities, involvement of community members, and persuasion skills are the most important (Kasperson et al., 1992; Petts, 1992). Based on survey data in Switzerland, Frey et al. (1996) find that residents consider health and safety as rights that should never be traded and that generally, compensatory procedures purely based on price incentives are rarely successful. Therefore, people do not increase their propensity to accept hazardous facilities even if economic incentives are offered. Portney (1991) reports that U.S. states that rely on compensation-based development have experienced no greater success than those using other methods. Moreover, pure money compensation has a disappointing track record at least in the context of facilities threatening health or injury risk (O'Hare 2010).

There is, however, support for the view that monetary compensation can be effective: in a review on compensation schemes for noxious facilities, economic incentives are found to be helpful for the cases of low or moderate risk sites such as waste landfill sites, incinerators, and prisons (Coursey and Kim, 1997).

This implies that success in the face of opposition cannot be achieved by any single device, especially cash payments (Frey and Oberholzer-Gee, 1996; Frey et al., 1996; Gibson, 2005; Hermansson, 2007; Schively, 2007). A compensation mechanism must be viewed as a component in the overall strategy to deal with opposition to development (Kunreuther et al., 1987). One needs to view citizens and stakeholders as optimizing something more complicated than wealth, or even wealth plus some money equivalent of expected health (O'Hare, 2010). Rather, incentive packages consisting of monetary and non-monetary incentives may be just as, if not more important, in eliciting support as single monetary incentives (Carnes et al., 1983).

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