

Delivering a 21st Century Infrastructure for Britain

Policy
Exchange 

Dieter Helm, James Wardlaw
and Ben Caldecott



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Executive Summary

The importance of infrastructure cannot be understated. In a global economy companies can choose to locate production, head offices and back offices wherever their needs are best served. Britain has some significant advantages – flexible labour markets, world class universities, the English language, the City of London – but these are counterbalanced by weak infrastructure. The relative positions of Britain and France demonstrate the importance of infrastructure. France has higher productivity – \$53.7 per hour worked compared to the UK’s \$45.4 – despite its less flexible labour markets, in large measure due to its excellent infrastructure.¹

The UK is at a distinct disadvantage compared to both European and global competitors. The CBI has found that 70% of senior business figures consider the UK’s infrastructure to be poor and that for 85% of respondents this has an impact on investment decisions.² More recently, the CBI has found that the quality of London’s infrastructure is slipping, with 61% of firms agreeing that the road network was getting even worse.³

Summary table – Likely minimum level of infrastructure investment required in Britain by 2020

Sector	Requirement	Cost (£ billion)
Energy	Replacement requirement	42
Energy	Investment in the networks	65
Energy	Renewables	136
Energy	Energy efficiency	21
Transport	Rail networks and high speed lines	69
Transport	London transport	32
Transport	Roads	9
Transport	Air transport	10
Communications	Nationwide roll-out of Fibre to the Cabinet/Very High Speed DSL (FTTC/VDSL)	5
Water	Water and sewerage networks	37
Water	Flood and coastal defences	8
TOTAL		434

1 OECD estimates of labour productivity levels, <http://stats.oecd.org/Index.aspx?DatasetCode=LEVEL>

2 Transport Select Committee, Seventh Report, 2005

3 “Businesses warn London must keep up with global rivals”, CBI, 2008 <http://www.cbi.org.uk/ndbs/Press.nsf/0363c1f07c6ca12a8025671c00381cc7/cb6edeeb281e4c20802575120046981f?OpenDocument>

Few would choose to locate in Britain because of its infrastructure. Much of it needs renewal or replacement. Simultaneously replacing our ageing infrastructure and investing in new infrastructure to improve our competitiveness, while meeting the challenge of decarbonisation means that the scale of the required infrastructure spend is potentially enormous. The estimates provided in this report are £434 billion by 2020. These estimates are, however, extremely conservative and the actual figure is likely to be upwards of £500 billion. This amounts to an annual investment programme of some £50 billion per annum for the coming decade.

Such an amount needs to be added to the investment requirements in the public sector infrastructure – notably schools, hospitals and public sector IT networks. There are upgrades for police, social security and defence infrastructure to be added as well. The sectors considered here form only part of the total picture. The bits left out include mobile networks and masts, air traffic control, postal services and many more. These all add to the total. The aggregate presented in the above summary table is therefore almost certainly a conservative one.

The economic crisis has highlighted the potential difficulties for Britain in financing this scale of infrastructure investment by 2020. Deep structural weaknesses have been revealed. The state of the public finances is widely agreed to be unsustainable and additional spending in the cause of a stimulus has added to the debt.

In contrast, encouraging infrastructure investment has significant advantages over attempts to boost consumption. The key difference from a macroeconomic perspective is that it creates assets to offset against the borrowing, while at the same time contributing to aggregate demand. But it has an additional and, arguably, more important role: it addresses the productivity and competitiveness of the British economy by improving the energy, transport, communications and water systems which make a substantial contribution to the costs of consumers and businesses.

To deliver this infrastructure investment so that it can stimulate economic growth sustainably, whilst addressing our significant infrastructure failures, we need to do four things. First, at a macro level we need to ensure that we move towards a sustainable consumption path – the British economy needs higher levels of savings to enable more investment. The economic crisis has raised fundamental questions about the ‘British economic model’, based upon high consumption and high borrowing. We argue that it would be better to focus on investment rather than consumption, creating assets to set against the debt. And amongst investment opportunities, infrastructure has considerable merits, not least because it increases productivity and competitiveness, as well as social inclusion.

Second, we must ensure that after the credit crunch the transmission mechanism from savings to investment is as smooth and cost-effective as it can be. This means finance must be available for infrastructure projects over long enough periods and at the lowest costs possible.

Third, we need to co-ordinate and prioritise infrastructure investments across the economy. Britain has a poor track record of doing this effectively and the plethora of government and government-sponsored organisations in this area could work more effectively if brought together. These organisations are shown in the table below.

Summary table – Government and government sponsored bodies involved in infrastructure financing in the UK

Organisation	Year founded
Public Works Loan Board (PWLb)	1793
Centre for the Protection of National Infrastructure	1989
Partnerships UK (PUK)	2000
Infrastructure Planning Commission (IPC)	2008
The Treasury Infrastructure Finance Unit (TIFU)	2009
Infrastructure UK	2009

Finally, given the size of accumulated government debt, as much infrastructure investment as possible should be undertaken off government balance sheet and financed by the private sector. This need not increase the costs of infrastructure projects – in fact it can reduce them significantly – as long as government creates a low-risk framework for encouraging investment.

To help to achieve these objectives, the Government should adopt the following recommendations. The choice is clear, as are the consequences. The economic crisis can prove the catalyst to a more imaginative approach to infrastructure – holding up demand, creating jobs and providing future generations with a set of assets. The Victorians did it: the current generation needs to repeat it.

Policy recommendations to raise the level of savings available for infrastructure investment:

- 1. To expand retail investments in infrastructure and utilities, the Government should allow a proportion of (expanded) Individual Savings Accounts (ISAs) in this category.** While the Government has undermined savings through monetary and fiscal policies since 2000, there have been contradictory mechanisms to encourage savings such as ISAs. One way of expanding retail investments in infrastructure and utilities is to allow a proportion of (expanded) ISAs in this category.
- 2. Government should address the tax status of regulated asset base (RAB) based investments and make interest on RAB-based bonds tax free for retail and pension fund investors.** The utilities and infrastructure areas represent a good case for a priority lowering of tax on investments. Their wider public benefit is not reflected in prices, and the internalisation of these externalities from networks and low-carbon technologies merits a positive discrimination in their favour. As a result, interest on RAB-based bonds should be tax-free.
- 3. Pension and life funds should be encouraged to play a greater role in channelling savings into infrastructure projects.** Pension and life funds are the principal vehicles for savings. They have long-term liabilities, and utilities have long-term time-inconsistency exposures and long-lived physical assets. The RAB provides a means through which savings can be channelled by financial institutions into infrastructure investments.

Policy recommendations to reduce the cost of capital and move infrastructure investment off the Government balance sheet:

- 4. Government should significantly reduce the cost of capital for financing infrastructure projects by credibly protecting investors through reforming and expanding the number of sectors covered by a RAB.** There is a significant difference between the costs of capital under different regulatory regimes.

Private finance initiative (PFI) projects have turned out to have relatively high costs of capital, whereas price-capped, RAB networks have had much lower costs of capital. A 1% change in the cost of capital on the total programme of £500 billion is worth £5 billion per annum. Hence a great deal rides upon whether the regulatory system and the role of government are designed to hold down the cost of capital. The RAB is protected by the duty that is placed upon regulators to finance the functions of the business, including the RAB. Understood in this way, the equity risk in the RAB for the company is zero – it has been transferred to the customers who are compelled to pay for the RAB (or, in the case of government guarantees and subsidies, to the taxpayers). This has a radical implication. If the RAB is guaranteed, it can be financed by debt, and that debt in turn is effectively guaranteed through the duty to finance. The cost of the RAB should therefore be very close to that of government borrowing. Indeed, were investors to lose faith in the creditworthiness of government bonds, the RAB might actually become lower risk because investors have physical assets to fall back on. In a period of inflation, this could be especially valuable security.

5. **To begin with, the RAB concept should be extended quickly to include the decarbonisation programme, high-speed rail and road transport and much of the PFI programme.** For decarbonisation this would include renewables, nuclear and carbon capture and storage (CCS) electricity generation. The obligations and levies which have been created on an ad hoc basis can be given a solid foundation and this might be termed the Low Carbon Obligation. The RAB could also be introduced for roads, instead of current customers paying for current investment on a pay-as-you-go basis out of general tax revenue, and much of the PFI programme could be regularised in this way too. All of this would reduce the cost of capital thereby saving significant sums of money and taking significant future investment requirements off the Government balance sheet – both critically important in straitened fiscal times.
6. **We need to adopt a more consistent regulatory approach towards the allowed return and cost of capital.** Complexity and inconsistency deter investors. Understanding the nuances of each industry every five-year cycle is not something that encourages investment – capital market participants and analysts have trouble understanding the plethora of small differences between sectors and periods. Introducing greater consistency across the various regulated sectors should lead to a lower cost of capital.

Policy recommendations to increase the availability of capital and integrate UK infrastructure policy:

7. **The UK should establish an infrastructure bank (UKIB), which draws on elements of Infrastructure Australia, KfW in Germany and NTMA in Ireland.** It would encompass the public works loan board (PWLb), the Treasury infrastructure finance unit (TIFU) and Partnerships UK (PUK). The prize is an institution which facilitates the introduction of private sector capi-

tal without crowding it out, finances itself with a government guarantee, aims to break even with any dividends reinvested, and whose liabilities do not score in the National Accounts but whose activities are defined by national priorities. The UKIB would help to finance the construction phases of infrastructure projects before they become operational and cash flow producing. The prospective establishment of Infrastructure UK as foreshadowed in the *Building Britain's Future* report of July 2009 may well go some of the way towards identifying priorities, but a bank which provides finance will be significantly more effective than another advisory body or centre of excellence.

- 8. In straitened fiscal times more emphasis should be placed on recycling investment and considering the more mature assets that the Government might sell in order to free up funds for investment in greenfield projects.** The Operational Efficiency Review in the run up to the 2009 Budget has not created a framework with the right incentives. Consequently departments do not identify assets that could be sold and the proceeds reinvested. An example of this kind of missed opportunity is not selling a concession to operate and collect tolls on the Dartford crossing to fund improvement of the M25.
- 9. The Government needs to introduce national infrastructure accounts with common methodologies to calculate the infrastructure requirements of the UK economy.** It is incredibly difficult to measure precisely the scale of the infrastructure challenge we face. There is no national asset register and no national evaluation of depreciation. The immediate consequence is that it is very difficult to compare capital expenditure (capex) programmes across different sectors. As a result, any estimate of the requirements in quantitative terms is bound to be open to considerable uncertainty. It highlights how little attention has been given to these issues.
- 10. The rating agencies should be removed from the regulatory architecture where possible.** The track record of the rating agencies in providing early warning radar is at best mixed. Rather than investment grade rating requirements for regulated industries, a series of explicit credit and liquidity ratios should be embedded in regulatory licences, which, if tripped, would lock up cashflow. This is designed to avoid excessive withdrawal of surplus cash from the regulated business and to trigger cash trapping in adverse circumstances. The effect of including an investment grade licence condition is to devolve an important element of regulation to the rating agencies, which will increasingly be regulated themselves. This anomalous situation, in which rating agencies are at the same time both regulated and regulators, could give rise to conflicts.

Introduction

Our entire economy and society rest on the infrastructure around us. The basic human needs of the 21st century – energy, water, transport, communications – all rely on networks, many of which are in urgent need of renewal. Looking forward, the twin challenges of economic globalisation and climate change make infrastructure all the more important to ensuring Britain’s economic competitiveness and delivering the low-carbon transition the climate demands.

The importance of infrastructure to the economy cannot be understated. In a globally open economy companies can choose to locate production, head offices and back offices wherever their needs are best served. Britain has some significant advantages – flexible labour markets, the English language, the City of London – but these are counteracted by weak infrastructure. The relative positions of Britain and France demonstrate the importance of infrastructure. France has higher productivity – \$53.7 per hour worked compared to the UK’s \$45.4 – despite its less flexible labour markets, in large measure due to its excellent infrastructure.⁴

In the context of the recession, infrastructure is a good example of the sort of stimulus spending which makes sense because it rebalances the economy. Investing in infrastructure is a much better strategy than increasing debt to drive up consumption again. The four major sectors investigated in this report – energy, transport, communications and water – are all vital to our future economic competitiveness as well as in need of substantial investment in the coming decades.

When it comes to transport, the UK is already at a distinct disadvantage compared to both European and global competitors. The Eddington Review cited a potential cost of £22 billion per annum in increased congestion by 2025 if the transport network does not keep up with demand.⁵ The CBI has found that 70% of senior business figures consider the UK’s infrastructure to be poor and that for 85% of respondents this has an impact on investment decisions.⁶ More recently, the CBI has found that the quality of London’s transport infrastructure is slipping, with 61% of firms agreeing that the road network is getting even worse.⁷

The UK’s motorway network is significantly less extensive than that of comparable European competitors even when adjusted for population and density.⁸ Heathrow is much more congested than its main rivals; its runways operate at 98% of capacity compared to Paris Charles de Gaulle (73.5%), Frankfurt (74.2%) and Schiphol (73.3%).⁹ Commuter train routes into London are horrifically crowded for an international city, while the rest of the country (with the exception of Kent) lacks access to high-speed rail lines to mainland Europe.

Transport is critical to economic competitiveness in a global economy. The British Chambers of Commerce calculates that the economic benefits of a third runway at Heathrow would be about £30 billion in increased productivity and wider economic benefits.¹⁰ Global financial institutions, high-tech manufacturing

4 OECD estimates of labour productivity levels; <http://stats.oecd.org/Index.aspx?DatasetCode=LEVEL>

5 Eddington R, *The Eddington Transport Study*, HMSO, December 2006, p 6

6 Transport Select Committee, op cit,

7 CBI, op cit

8 Wellings R and Lipson B, *Towards Better Transport*, ed Hartwich O, Policy Exchange, 2008, p 9

9 “Vulnerable to foreign competition”, BAA; http://www.heathrowairport.com/portal/controller/dispatcher.jsp?CID=23c72bf00e423110VgnVCM1000036821c0a____&ChID=bbd9abefeb55110VgnVCM1000036821c0a____&Ct=B2C_CT_GENERAL&ChID=448c6a4c7f1b0010VgnVCM200000357e120a____&ChPath=Home%5EHeathrow%5EGeneral%5EOur+business+and+community%5EEconomic+benefits

10 “A third runway at Heathrow would add £30 billion to UK economy”, British Chambers of Commerce, 2009 http://www.britishchambers.org.uk/zones/policy/press-releases_1/a-third-runway-at-heathrow-would-add-30-billion-to-uk-economy-says-new-study.html

and small businesses all rely on a high-quality, reliable transport infrastructure to distribute and export their products and services. The UK must compete with both European competitors with better infrastructure and developing economic centres prepared to invest very heavily, and risks being left in the slow lane. The economic returns of well-targeted infrastructure investment can be up to £10 per £1 spent.¹¹ The challenge is to deliver the private investment to deliver public goods.

Transport is also a key sector for delivering on climate change targets. Reducing transport congestion is of crucial importance to greenhouse gas emissions and air quality, as well as quality of life. Developing a high-speed rail network to displace internal flights will reduce emissions from internal travel. Crossrail and an upgraded London Underground would reduce congestion in the capital as well improving its links to areas outside.

Communications infrastructure represents an enormous opportunity. Broadband has become almost a basic social need – and is certainly a requirement for a successful business in a modern economy. Delivering broadband networks with sufficient capacity and speed is vital for the future of much of Britain's high value service economy, as well as reducing emissions from avoidable travel. If the UK aims to be a global hub of finance, culture, communications and technology then digital communications networks are of paramount importance. Delivering broadband with sufficient capacity and speed to deliver on an ambitious vision of the future should be the priority for government in this field.

Britain faces a tough challenge. Competing in a 21st century world with (in places) 1970s electricity infrastructure, 19th century water networks and postwar transport networks is simply not possible. A ruthlessly competitive global economy and the challenges of climate change mean that sticking-plaster updates are no longer sufficient. The UK is in need of a step change in its infrastructure provision. This report details the challenge and how to face it.

The report is divided into the two sections. The first, by Dieter Helm, discusses the importance of investment over consumption, why infrastructure is important and the scale of the investment challenge. It also looks at how infrastructure might be financed, and how the infrastructure investment fits into the wider framework of economic policy.

The second section, by James Wardlaw, suggests how Britain should proceed towards an integrated infrastructure finance policy and how the institutional architecture in this area can be improved. It also looks at the state of the UK infrastructure finance market, how to reduce risk for investors, introduce consistency across the regulators and reappraise the role of the rating agencies.

¹¹ Eddington R, op cit, p6

SECTION 1

Infrastructure, investment and the economic crisis

Dieter Helm

The British economy at the end of the first decade of the 21st century is not in good shape. The credit crunch and subsequent recession have revealed deep structural weaknesses. The state of the public finances is widely agreed to be unsustainable and additional spending in the cause of a Keynesian stimulus has added to the debt. Consumer spending, which had been based on rising house prices and increased consumer borrowing, has fallen sharply, and both consumers and industry are trying to reduce their debt levels.

The bursting of the Brown boom and the painful recognition that the business cycle has not been abolished have been accompanied by two further reality checks. First, North Sea oil and gas are substantially depleted: Britain now has to switch back to energy imports and sterling no longer has a petro-currency status. The sharp devaluation has reinforced the second setback: the City of London is unlikely to play such a large part as the golden goose for the economy and the Treasury as it has since financial liberalisation.

In this much colder financial climate, numerous proposals and economic plans have been put forward, many involving very substantial deficit spending in an attempt to boost consumption by increasing public borrowing yet further. As part of this debate some have suggested that spending on infrastructure and green investment should play a part.

Encouraging infrastructure investment has many advantages over attempts to boost consumption. The key difference from a macroeconomic perspective is that it creates assets to offset against the borrowing, while at the same time contributing to aggregate demand. But it has an additional and, arguably, more important role: it addresses the productivity and competitiveness of the British economy by improving the energy, transport, communications and water systems that make a substantial contribution to the costs of consumers and businesses.

The state of these network infrastructures is generally considered poor; few would choose to locate in Britain because of its infrastructure. Much of it needs renewal or replacement. It is also increasingly overtaken by technological progress and the new environmental constraints. Britain's infrastructure is not fit for the digital age and much of it is very carbon-intensive. Broadband is providing direct

“ Britain's infrastructure is not fit for the digital age and much of it is very carbon-intensive ”

access to information technologies, but it is also revolutionising the more traditional networks. Energy networks can now be “smart”, as can metering. Even water can be provided in much more intelligent ways and waste management is open to a host of technological innovations.

Analysis and wider public debate tend to focus on the needs of individual industries, with little focus on aggregating the total required infrastructure spend or on the common problems in all sectors. The reason that the aggregate matters is not only because it turns out to be enormous, but that it needs to be set in the wider macroeconomic context. Spending on infrastructure rather than consumption may be preferable, but, as with the consumption boost, it too needs to be financed. Infrastructure spending on the scale set out in this report raises the question as to whether that finance will be forthcoming, especially when governments everywhere are tapping the bond markets for unprecedented sums.

The aims of this section are to set the infrastructure requirements in this macroeconomic context; to explain why infrastructure matters; to provide some crude estimates of the enormous scale of the spend in the coming decade that has already been indicated by government and regulators; and to explain how it can be financed, notably through the development of the regulatory regime. The section therefore provides an integration of the immediate needs to address the economic crisis with a longer-term way to re-equip the British economy, in the aftermath of the North Sea windfall and on the assumption that the economy will need to restructure somewhat from the overwhelming dependency on financial services.

1

Infrastructure and the economic crisis: why investment is better than consumption

I. The origins of the crisis

The origins of the economic crisis lie in the 1990s. The technological revolution in telecommunications and the internet – and the associated communications infrastructure – changed all household and company practices. Faxes, mobile phones and the web, coupled with the mass production of computers, introduced changes in production techniques perhaps as profound as those which followed the coming of the railways in the 1840s and electricity in the 1920s and 1930s. It was an infrastructure revolution.

Such a revolution brought with it the inevitable “animal spirits”.¹² The belief in progress and ever greater wealth was powerfully reinforced, creating a wave of optimism in markets. Privatisation, liberalisation and competition were facilitated by the new technologies, reducing transaction costs. Almost anything could be traded through markets, and this was further encouraged by financial liberalisation. The largely unexpected collapse of the Soviet empire only added to the market exuberance. Markets had triumphed over communist state planning.

The dotcom boom reached its zenith at the end of the 1990s. New companies came to market on the back of simple business plans, with the “burn rate” of investors’ funds a key variable. Companies such as Lastminute.com and Boo.com attracted often gullible investors, while new trading models like that of Enron hid considerable market exposure.

The crash, when it came in 2000, was brutal, and optimism was displaced by panic. The reaction of policymakers was to try to buy off the recession which was expected to follow. Monetary policy was eased, driving down real interest rates towards zero. In the US and the UK, fiscal policy was also used to boost demand: in the former through tax cuts, and in the latter through the rapid expansion of public expenditure, laying the seed for the structural deficits that followed.

For a time it worked. Consumption responded and there was the illusion of economic growth, which was, in effect, the mirror of growing public and private borrowing on the back of very low interest rates. These fed through to asset values too,

“ There was the illusion of economic growth, which was, in effect, the mirror of growing public and private borrowing on the back of very low interest rates. ”

12 For a discussion of the importance of animal spirits in explaining the economic boom see Akerlof G and Shiller R, *Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters for Global Capitalism*, Princeton University Press, 2009

and soon house prices started to rise and equities recover. The very low cost of debt encouraged leverage across the board and financial innovations allowed that leverage to be geared up. A flight from equity to debt was the result. The infrastructure utilities were prime targets for this financial engineering

For banks and financial institutions, this was a new bonanza. Building societies no longer looked to the pedestrian retail deposits as their prime source of capital. Now they ventured into the wholesale markets with, in Northern Rock's case, spectacular results. In the US, banks discovered that if mortgages were packaged together, sub-

“People acted as though they believed Brown's assertion that there would be no more boom and bust. This turned out not to be true”

prime could be disguised by prime, and gullible rating agencies could give the bundle a high rating. Banks and other financial institutions inside and outside the US scrambled to get a piece of the action.

Investors and politicians fell for the seductive argument that independent central banks had magically solved the problem of the business cycle. The low interest rates were supposed to reflect the apparent low-risk environment, and inflation remained subdued by the impact of cheap imports from the Far East. There would be no more “boom and bust”.

It turned out to be a rather different story. There had been no transformation of the fundamentals of the business cycle. Indeed, the post-2000 boom proved to be extremely fragile. Rising oil prices removed one of its platforms, and in 2006 real interest rates began to move back towards their long-run rate of around 2%. It was enough to pull the rug from out of the sub-prime market as the housing bubble burst in the US. The UK, Spain and Ireland experienced similar housing bubbles, and lots of British banks found they had taken on too much risky debt, including sub-prime.

There followed a credit crunch on a scale not seen since the 1930s. But, unlike then, the banking system is now global, and hence the fall-out from the collapse of banks has been felt globally too. Governments and central banks scurried to cope with the implosion. Northern Rock was bailed out. Next came the guarantee of retail deposits across most of the banking industry. The Bank of England in effect became the inter-bank market. Banks were effectively nationalised or put on government life-support systems. The failure of Lehman Brothers, and the absence of a rescue, unsettled markets further, but gradually the central banks completed the underwriting process for their financial sectors.

II. The consumption-based Keynesian response

To these immediate rescue efforts has been added a rerun of the monetary and fiscal policies introduced in response to the 2000 crash, but this time on an altogether more massive scale. Interest rates in real terms have been reduced to near zero, and almost to this level in nominal terms too. Quantitative easing (QE) has been applied: in Britain, £175 billion has been set aside to buy up gilts and corporate bonds (some in the utility sector).

But it is the scale of the fiscal stimulus which has dwarfed anything previously attempted. In Britain, the government embarked on spending over 10% GDP (and the US went slightly farther). This fiscal expansion is planned to carry on until around 2016-17 if growth resumes quickly, and by implication, for over a decade if it does not.

The credit crunch needs to be separated from the fiscal stimulus. Britain has been running a structural deficit since 2000, implying that consumption was above its sustainable level. This excess consumption was reinforced by the monetary policy: very low interest rates encouraged higher levels of borrowing for houses and other assets, and also on credit cards.

The justification for the borrowing rested on the assumption that tomorrow would be better than today: house prices would carry on going up, full employment was now the norm, and rising equity markets would pay for pensions. In effect, it was assumed that the business cycle had been abolished – people acted as though they believed Brown’s assertion that there would be no more boom and bust.

This turned out not to be true. Consumers now face a very different reality: they have discovered that positive savings should be the norm. There is a backlog of savings to be made up to address inadequate pension provisions; lower than expected house prices; credit card borrowing and loans; future tax rises and the expectation that many services provided publicly may be reduced or need to be paid for privately.

The prudent savings ratio may therefore be considerably higher than the conventional figure of 7%. But the UK and US Governments have chosen not to make the transition to a lower consumption/higher savings world, but to try to hold up consumption through very large-scale public borrowing. In other words, while reverse gear would be necessary to reach the sustainable level, the policy was in effect to push harder on the accelerator. The rationale was the Keynesian multiplier: that the fiscal injection would trigger economic activity that multiplied through the economy.

There are two possible outcomes from this debt-based acceleration. The first is that it does not work. Consumers see through the temporary boost to the repayment reality. Since government spending on the public sector typically has lower productivity growth than spending on the private sector, they save even more, more than offsetting the demand boost. Furthermore, the government’s borrowing crowds out the private sector through higher interest rates. The future is therefore expected to be worse than it would have been had government not added the fiscal stimulus. This neo-Ricardian approach attacks the heart of Keynesianism, for the stimulus depends for its effect on the ignorance or irrationality of the consumer, who mistakes a temporary boost for a permanent one. The resulting savings need somewhere to go; the policy issue at the core of this report is how to make savings equal investment – how to facilitate and improve the transmission mechanisms.

“The policy issue at the core of this report is how to make savings equal investment – how to facilitate and improve the transmission mechanisms”

The second possibility is that it does work and consumption goes up. If this happens, the danger is that the additional spending feeds through to inflation, which the monetary authorities are then required to stop. It is widely asserted that we now know how to control inflation through independent central banks. However, this assumption is questionable: imagine a very sharp rise in nominal interest rates in the context of a weak economy. Inflation might prove rather convenient, since – as in the 1970s – it can wipe out the creditors. If this is the outcome, the consequences for infrastructure investment are considerable, not the least being the possibility of a sharp rise in the cost of capital.

The scale of the debt may turn out not to be financeable without inflation: it may simply be unsustainable. There may be no democratic majority for the sorts of tax increases necessary to pay the interest and principal back. Already it is unfunded, and QE has added an additional element.

III. Towards the sustainable consumption path

An alternative approach to the current economic crisis starts with fixing the banking crisis, before moving on to effecting the transition to the sustainable consumption path. By implication, this takes us to the sustainable savings path. The savings then need to be translated into investment and the investment needs to reflect the economic opportunities in the economy, one of which is the need to rebuild Britain's infrastructure.

The sustainable consumption path is the level of consumption that can be maintained through time on the basis of prices that fully incorporate environmental effects and other externalities. It can grow through time as a result of changes in factor inputs – capital and labour – many of which are due to changes in technology and knowledge.

The required savings ratio depends on the age profile of the workforce, the underlying growth and productivity rates, and the stock of inherited assets and debt. The British position is weak on all counts. The population is ageing, imposing not only a greater pensions burden but also requiring more medical and care facilities. The productivity growth rate is lower in the public sector, and with a big, and growing, public sector it is likely to be low. For reasons which will be explained below, the impact of poor infrastructure on productivity is likely to remain a drag on growth.

The stock of debt is rising sharply, and the value of the assets has not only been reduced in the economic downturn, but two core assets are in particularly bad shape: North Sea oil and gas are largely depleted, and the City has taken a substantial hit in the credit crunch. Finally, the externalities are substantial – notably on climate change. Even without the budget deficit, the consumption path would have been unsustainable since it has been at the expense of the climate and biodiversity. Manmade capital can only be traded against environmental assets – notably the climate and biodiversity – to the extent that they are substitutes. The conventional assumption that this substitution is one for one is not tenable.¹³ Taking all factors into account, the assets have been run down as part of the price of the (excess) consumption.

Turning saving into investment is complex. In the current context, there is the possibility that the economy gets stuck in a liquidity trap – that animal spirits have been dampened and that savings are hoarded in cash. In such circumstances, there are a variety of ways of effecting the transmission. In the 1940s, governments used high taxation to provide the monies for investment channelled through nationalised industries. In other words, the State applied a form of compulsory savings and translated this into reconstruction. For private savings, the power of government is less direct since it has to work with the grain of the market. It has the more difficult task of facilitating voluntary investment. In the infrastructure arena, this facilitation depends on the regulatory regime, which in turn helps to determine the cost of capital. A number of ways of ensuring the transmission of savings into infrastructure investment are set out later in this section. But first we need to establish why infrastructure is a special asset class – why it matters.

¹³ This is implicitly assumed in, for example, Stern N, *The Economics of Climate Change*, Cambridge University Press, 2006. For a critique see Helm D, "Climate-change Policy – why has so little been achieved?", *Oxford Review of Economic Policy*, 24:2, 211–238, 2008

2

Why infrastructure matters

Why the private sector will under-invest in infrastructure

There are many investment projects in the British economy that could and should be pursued, but in almost all cases these are left to the private sector to work out whether net present values are positive and make it profitable to finance them. Infrastructure is different in rather complex ways, many of them mutually reinforcing. There are multiple market failures, which together are sufficient to conclude that the private sector, left to its own devices, will produce a seriously sub-optimal level of provision. Put simply, there will be inadequate energy, transport, communications and water networks, to the detriment of consumers and industry.

This overarching conclusion is commonly acknowledged, yet the complex market failures, which include public goods, time inconsistency, complementarity, and social and environmental externalities, are poorly understood. As a result, it is not surprising that the forms of government intervention are often inadequate to the task.

Networks are systems best considered from an economic perspective as a whole rather than concentrating on the disaggregated parts. In economic terms, these systems are *public goods*, which in theory are non-excludable and non-rival. The marginal costs are close to zero until the network is congested and, as long as they are low, the economy as a whole is best off if as many consumers and firms use the networks as gain positive benefits from doing so. As long as they pay their marginal costs, their consumption adds to welfare.

The obvious problem for private investors is that the implied level of use is well beyond that which remunerates the fixed and sunk costs – the average rather than marginal costs. Up to the congestion point, if price equals marginal cost, it is close to zero. Thus the optimal system needs to be first defined and then a mechanism has to be provided to ensure that the average costs are recovered, while ensuring as much access as possible.

The implications are substantial: the private sector will not deliver the optimal system. This means that it is for government to decide its scope and limits. Government can delegate this to regulators, but it cannot evade the responsibility. When there is general excess supply, it is not a problem, but when network systems need expansion, it is. Looking forward over the coming decade, these decisions are about broadband roll-out, smart grids and smart meters, high-speed

“The sustainable consumption path is the level of consumption that can be maintained through time on the basis of prices that fully incorporate environmental effects and other externalities”

rail and airport expansion, water resources and sewerage disposal systems. All of these have come onto the political agenda, but there has been a degree of reluctance to acknowledge the central part played by government in defining the dimensions of the systems.

A further implication is that government has a central role in deciding how network systems should be paid for and in ensuring that investors get a reasonable return. This is the reason why regulation is so pervasive. Its role is not simply to prevent monopoly abuse, but to ensure that customers or taxpayers pay the full costs.

Ensuring payment is complicated in networks and infrastructure more generally because of the time dimension. The investments are typically very long-lived – indeed, sometimes exceeding a century, as in the case of Victorian sewers and even some local electricity cables. Investors faced with these sorts of time horizons are exposed to the risk that there will be political and regulatory opportunism: governments may try to persuade the investors to sink the costs, and then push prices down towards marginal costs. As long as some contribution is made above marginal costs, it makes sense, particularly to the expropriated owners, to keep operating the assets.

This is the *time-inconsistency* problem, familiar in monetary policy. In response, investors want to know that they will be protected – they need some sort of a contract which ensures that customers and taxpayers (and regulators and government acting on their behalf) will not behave opportunistically. As we shall see, a major innovation of the British regulatory system to address the problem has been the concept of a protected regulatory asset base (RAB). Assets that have been created go into these RABs, and then the regulators then have a duty to ensure that they are properly remunerated.

The scale of the fixed and sunk costs relative to operating costs is such that, for most infrastructure projects, the dominant variable is the cost of capital. This is extremely sensitive to political and regulatory risks, of which the time-inconsistency problem is the most acute. So it turns out that finding a credible solution to time inconsistency has a significant impact on the core costs of the project. It is therefore not surprising that there is a significant difference between the costs of capital under different regulatory regimes: private finance initiative (PFI) projects have relatively high costs of capital compared to price-capped RAB-based networks.

IV. Why under-investment is detrimental to the economy as a whole

These costs matter not just for the direct users of the networks and infrastructure. These sorts of investments are *complementary* to the rest of the economy. They impact on productivity and competitiveness and hence on the performance of the economy as a whole. This point has been recognised particularly in transport, where the Eddington Report established these wider impacts.¹⁴ The plan for Digital Britain is similarly premised on this wider benefit.¹⁵

Comparisons between France and Britain highlight the aggregate productivity differences: in the former case, the superior performance is in the context of sclerotic labour markets and less private ownership, competition and liberalisation. Part of the difference can probably be ascribed to the very different quality and

¹⁴ Eddington R, op cit

¹⁵ “Digital Britain: Final Report”, Department for Culture, Media and Sport and Department for Business, Innovation and Skills, Cm 7650, June 2009

extent of the infrastructure. The OECD has highlighted these benefits, but it is remarkable how little empirical research has been carried out.¹⁶ Sudden infrastructure failures, such as power cuts, have measurable impacts, but the effects of poor quality and higher costs over time are not well documented.

These complementarities are not just in terms of wider economic performance: they have *social externalities* – impacts on consumers and social inclusion. The development of infrastructure networks is one of the mechanisms for ensuring that some of the basic social primary goods that citizens need to participate in society are provided. Extension of the electricity and gas networks brings power and heat to households, and particularly to vulnerable and peripheral areas. Typically, these customers cannot pay the average costs, and hence marginal cost pricing is especially important to them. For much of the postwar period, networks substantially cross-subsidised between customer classes. It remains the case that distribution networks have the capacity to price-discriminate because of their monopoly nature, whereas liberalised suppliers facing competitive threats do not. It is for this reason that social considerations should be kept in distribution not supply, but in fact have not, making fuel poverty, in particular hard to tackle.

V. Infrastructure failures and the climate change objectives

Networks play a core role in environmental matters: much pollution flows through them. Electricity and gas are the obvious examples. Transport is largely a carbon-based activity. Water pollution flows through sewerage networks. There are important implicit environmental dimensions too. For example, broadband networks may enable people to work more remotely, reducing the need to travel and network design can improve energy efficiency and water resource management.

VI. The aggregate impact of infrastructure underinvestment

It is the job of government to decide how much should be provided and to design the regulatory regimes to minimise the costs of capital. Failure to do the former results in the inadequate infrastructure Britain has today. Failure to do the latter properly raises the cost of capital to the detriment of the economy as a whole. Not surprisingly, then, the British pay too much for inadequate infrastructure; a major investment programme is required to address this serious economic failure.

16 *Infrastructure to 2030 – Telecom, Land Transport, Water and Electricity*, Organization for Economic Co-operation and Development, 30th June, 2006

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How much infrastructure investment is needed? What is the scale of the problem?

Given the importance of infrastructure, the next question is the gap between its current state and what is required over the coming decade. The two decades after privatisation were a period in which the operational inefficiencies of the nationalised industries were gradually unwound. At privatisation, it was argued that the nationalised industries had tended to over-invest, had excess operating costs and were labour-biased.¹⁷ The establishment of private ownership created beneficiaries for efficiency gains – private shareholders – and RPI-X regulation was designed to make profit-maximisation equivalent to cost-minimisation. Fixed-price, fixed-period contracts were intended to make the privatised companies price-takers, and hence to mimic private competitive markets.¹⁸ The best way to make profits was to sweat the assets.

It rapidly transpired that, although the operational costs were brought down, asset-sweating also entailed an advantage to playing games with the capital expenditure (capex). The incentives on capex were complex. On the one hand, cutting capex against the pre-set targets at periodic review boosted short-term returns. The utilities had powerful incentives following privatisation to persuade the regulators to set high *ex ante* capex targets and then *ex post* to undershoot them. So, although much investment took place, it was subject to five-year “games”, raising doubts not only about the amount of capex, but, perhaps more significantly, its composition. On the other hand, there was the issue of whether to bid for more or less capex after allowing for the game-playing. Was it better to do more CAPEX, borrow more and end up with a higher RAB? Or was it better to minimise the capex? The answer depended on the returns; whether the allowed return exceeded the cost of capital for the capex itself and thereafter once it went into the RAB. It turned out to be about whether the strategy should be to grow or shrink the RAB, to which we return below.

A further sophistication on these incentive issues related to the type of investment and its timing. Would it be better to focus on projects that could be completed quickly and then rolled into the RAB at the end of the five-year period, or to go for bigger long-term projects that might take more than one period to complete? Again, the finer details of the application of RPI-X mattered, as did the way the treatment of capex interacted with the determination of the rate of return.

It would be very hard to argue that the RPI-X incentives produced the optimal investment incentives. It is probably impossible to work out how big the distor-

¹⁷ These arguments were also used against rate of return regulation in the debate which led to RPI-X. See Department of Industry and Littlechild S, 1983

¹⁸ Helm D, *From Review to Reality: the search for a credible energy policy*, Social Market Foundation, October 2006

tions have been, but what can be observed is the gap between what exists now and what is likely to be required over the coming decade in order to compete and to meet the environmental challenges. Few international companies would choose to locate in Britain because of its infrastructure; inadequate transport networks are perhaps the greatest deterrent.

The current regulatory approach takes a bottom-up approach and asks the question as to whether the five-year capex proposals are sufficiently robust to be accepted in the setting of the price cap. Looking from the top down, the question is whether the resulting infrastructures are fit for purpose. This is what motivates the broader investment strategy considerations in government white papers and longer-term analyses of the types of grids and networks we will need. The bottom-up approach is almost useless in considering whether we need new runways, high-speed rail links and smart grids, since these are all system questions.

Britain does not produce infrastructure accounts and government departments, regulators and utility companies do not use common methodologies. There is no national asset register, and no national evaluation of depreciation. We return later to the need to rectify this omission, but the immediate consequence is that it is very difficult to compare capex programmes across the infrastructures. As a result, any estimate of the requirements in quantitative terms is bound to be open to considerable uncertainty.

We can, however, take a stab at a broad description of what is required in each of the sectors. For each, there is information about the current investment spend, and there are a variety of government white papers, proposals and studies which provide some estimates of the likely future costs. It would be an enormous research project to try to unpack the details and place them on a common accounting basis. But it is worth getting a ball park estimate for what is potentially required and then to think through whether and how it might be delivered. It is with this limited and focused ambition that the numbers below are presented for each of the sectors.

In addition to the ball park nature of the estimates, some further caveats should be made about the numbers. Strictly, these should all be provided in the same (current) prices, and the projects should be discounted to take account of the timing of the costs. It is well beyond the scope of this summary to attempt to go through each item and recalibrate the cost estimates and it is an important criticism of government that such exercises are not conducted.

The very crudeness of the estimates summarised below has a virtue: it highlights just how uncertain the investment requirements are and how little consideration has been given to the aggregates.

Energy

The energy sector has an enormous investment requirement over the next decade – perhaps half of the total spend. This is for five separate reasons: replacement, technical change, climate change, transport and energy efficiency.

The replacement requirement

The assets created in the large investment programme in the 1970s are now coming to the end of their lives and hence there is a big asset replacement programme.

Table 1: The replacement requirement¹⁹

Status	Requirement	Cost (£ billion)	Estimated timeframe
Minimum	Nuclear new build—10GW	22	2025
Alternative	Nuclear new build—12.8GW	38	2025
Minimum	6GW coal with CCS	15	2020
Minimum	10GW gas	5	2020
TOTAL		42	

Notes: Other uncosted or additional (possible) investments: (i) nuclear: bearing in mind the well-documented cost over-runs in the construction of the Olkiluoto nuclear plant in Finland, costs for a new nuclear plant could be closer to £5 billion rather than the £3.6 billion suggested to be at the top of the cost range by Government; (ii) coal CCS: this figure comprises four 400MW demonstration plants at the rates estimated by BERR. This has been added to an estimate for 6GW of CCS-ready coal generation assuming £0.5 billion per 800MW, as with the E.ON project at Kingsnorth. (iii) gas: based on the projected capital costs for SSE's plant at Marchwood of £400m for an 850MW plant.

19 "Meeting the Energy Challenge: A White Paper on Nuclear Power", BERR, January 2008, see www.berr.gov.uk/files/file43006.pdf; "Securing the UK's Energy Future", Ernst & Young, February, 2009; Kingsnorth cleaner coal plant, E.ON UK, see <http://www.eon-uk.com/generation/supercritical.aspx>; Scottish and Southern Energy, SSE venture to invest in new combined cycle gas turbine power station, see www.scottish-southern.co.uk/SSEinternet/index.aspx?id=2624&terms=Marchwood&searchtype=1&fragment=True.

20 "Transmission Price Control Review: Final Proposals", Ofgem, December 2006, see http://www.ofgem.gov.uk/Networks/Trans/PriceControls/TPCR4/ConsultationDecisionsResponses/Documents1/16342-20061201_TPCR%20Final%20Proposals_in_v71%206%20Final.pdf; "Gas Distribution Price Control Review: Final Proposals", Ofgem, December 2007, see <http://www.ofgem.gov.uk/Networks/GasDistr/GDPCR7-13/Documents1/final%20proposals.pdf>; Spreadsheet of Main Forecast Business Plan Questionnaire, Summary, Ofgem, March 2009, see <http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=205&refer=NETWORKS/ELECDIST/PRICECTRLS/DPCR5>; "Government Response to: Offshore Electricity Transmission: A Further Joint Ofgem/DECC Regulatory Policy Update", November 2008-January 2009, see <http://www.ofgem.gov.uk/Networks/offtrans/pdc/cdr/cons2009/Documents1/consultation2309.pdf>; Ernst & Young, "Securing the UK's Energy Future", February 2009; Smart Meter Roll Out: Market Model Definition & Evaluation Project, DECC (Baringa), April 2009, see http://www.decc.gov.uk/en/content/cms/consultations/smart_metering/smart_metering.aspx

This may be as much as 20-30GW – one –third of the existing power station fleet. The estimate for this depends very much on the choice of technology. The decision to promote up to four new coal power stations with limited carbon capture and storage (CCS) will make up perhaps 6GW. Some of the gap will be filled by wind power, but given the intermittent nature of wind, it will require more capacity in aggregate to back it up. In an optimistic scenario this might match the coal investments. The rest of the gap is likely to be made up from gas. At, say, an average of £1 billion per 1GW spread across the technologies, the total investment requirement is likely to be a minimum of £20 billion. Spread out over a longer time period is the replacement of existing nuclear power stations. This may contribute over £20 billion to the total – possibly much more.

The impact of technical change

Table 2: The impact of technical change—investment in the networks²⁰

Status	Requirement	Cost (£ billion)	Estimated timeframe
Minimum	Transmission—gas and electric	5	2015
Minimum	Distribution—gas	5	2015
Minimum	Distribution—electric	7	2015
Minimum	Offshore networks	15	2020
Minimum	Full roll-out—smart meters	13	2017
Likely add-on	Waste infrastructure	20	2020
TOTAL		65	

Notes: Other uncosted or additional (possible) investments: i) Smart grid: the recent 'UK Low Carbon Transition Plan' was keen to emphasise the plans to develop a 'smart grid'. Figures for such an investment remain elusive but are likely to be high. ii) LNG and West of Shetland: the plan also emphasised the need to continue investment in LNG storage and import facilities as well as investment to the West of Shetland to maximise the yield of North Sea oil and gas. iii) Electric cars: the accompanying 'Low Carbon Transport – A Greener Future' Document re-iterated the desire to encourage the use of electric cars. It is not clear how investment in the grid would need to adapt to accommodate the concomitant demands

Technical change is transforming the sector, perhaps on a scale experienced by the communication industries in the 1980s and 1990s. This implies a major upgrade in the design and functions of the main grids and distribution networks— towards smart grid and smart meters – rendering the grid an active intelligent network, rather than its traditional passive role. The table below lists the various components of network investment, some of which are relevant to the existing assets and some driven by technology change. The smart meter programme alone is estimated to cost at least £8 billion, and perhaps as much as £15 billion. The other network investments, covering distribution and transmission onshore and offshore, come in at considerably over £20 billion, and perhaps £32 billion.

Climate change and renewables

Addressing climate change requires an overwhelmingly fossil-fuel-based industry to de-carbonise rapidly. This necessitates the replacement of much of the generation capacity, involving a major renewables, nuclear and probably CCS investment programme. The EU climate change package sets the context for the renewables directive, requiring the UK to meet 15% of its energy needs from renewable sources by 2020.²¹ There has been a variety of estimates of the costs of the renewables programme, with £100 billion regularly quoted. Estimates depend very much on what precisely the cost base is – whether it is just the windmills themselves or the network and back-up required. The full Severn Barrage scheme is estimated at £18 billion. Beyond wind and tidal schemes, there is also renewable gas, recovered from waste and a range of opportunities for heat.

Estimates in the renewables area are further bedevilled by lobbying and optimism bias. The economic rents available are very considerable, and cost estimates are part of the process of capturing the benefits for private investors. CCS projects have been mentioned above under replacement, but the CCS component adds additional costs beyond the base estimated for the cost of providing each GW. It is not unreasonable to assume that four CCS units would cost in excess of an additional £1 billion and that the storage and network issues would be additional. The nuclear component then needs to be added, as discussed below.

Table 3: Renewables²²

Status	Requirement	Cost (£ billion)	Estimated timeframe
Minimum	Offshore wind	36	2020
Minimum	Onshore wind	13	2020
Minimum	BioEnergy	6	2020
Minimum	Wave and tidal	3	2020
Possible add-on	Severn Barrage—Cardiff Weston	18	2021
Alternative	Severn Barrage—Fleming Lagoon	2	2018
Alternative	Severn Barrage—Shoots Barrage	2	2019
Likely add-on	Renewable gas	10	2020
Minimum	Built environment	50	2020
TOTAL		136	

Note: Built environment refers to micro generation such as photovoltaics, solar thermal, heat pumps and micro-wind.

21 “Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources”, COM 19 final, CEC, 23 January 2008

22 How the UK can meet its target of 15% renewable energy, RAB (2020 Vision), June 2008, see <http://www.renewables-advisory-board.org.uk/vBulletin/showthread.php?t=136>; Severn Estuary Tidal Power, DECC, December 2008, see http://severntidalpowerconsultation.decc.gov.uk/supporting_documents; The Potential for Renewable Gas in the UK, National Grid, 30 January 2009, see <http://www.nationalgrid.com/uk/Media+Centre/Documents/bio-gas.htm>

The table below draws together Tables 1 and 3 and shows the total new and replacement generation investment required in the UK.

Table 4: Aggregate new and replacement generation investment²³

Status	Requirement	Cost (£ billion)	Estimated timeframe
Minimum	Nuclear new build—10GW (6 plants)	22	2025
Alternative	Nuclear new build—12.8GW (8 plants)	38	2025
Minimum	6 GW coal with CCS	15	2020
Minimum	10 GW Gas	5	2020
Minimum	Offshore wind	36	2020
Minimum	Onshore wind	13	2020
Minimum	BioEnergy	6	2020
Minimum	Wave and tidal	3	2020
Possible add-on	Severn Barrage—Cardiff Weston	18	2021
Alternative	Severn Barrage—Fleming Lagoon	2	2018
Alternative	Severn Barrage—Shoots Barrage	2	2019
Likely add-on	Renewable gas	10	2020
Minimum	Built environment	50	2020
TOTAL		178	

Notes: Other uncosted or additional (possible) investments: the expected decommissioning of nuclear power plants could cost as much as £50 billion.

23 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, January 2008, see <http://www.berr.gov.uk/files/file43006.pdf>; Ernst & Young, Securing the UK's Energy Future, February 2009; *Six Thousand Feet Under – Burying the Carbon Problem*, Policy Exchange, 2008, see <http://www.policyexchange.org.uk/publications/publication.cgi?id=28>; SSE venture to invest in new combined cycle gas turbine power station, Scottish and Southern Energy, see <http://www.scottish-southern.co.uk/SSEInternet/index.aspx?id=2624&terms=Marchwood&searchtype=1&fragment=true>; How the UK can meet its target of 15% renewable energy, RAB (2020 Vision), June 2008, see <http://www.renewables-advisory-board.org.uk/vBulletin/showthread.php?t=136>; DECC, Severn Estuary Tidal Power, December 2008, see http://severntidalpowerconsultation.decc.gov.uk/supporting_documents; The Potential for Renewable Gas in the UK, National Grid, 30 January 2009, see <http://www.national-grid.com/uk/Media+Centre/Documents/biogas.htm>

Electricity for transport

Transport is increasingly being electrified, with new types and levels of demand emerging. This is not simply about electric cars and the electrification of much of the rest of the railway network. It is also about creating new delivery networks for the charging of batteries and adapting to the energy that will as a result be stored in cars. There will need to be more generation capacity to meet the new demands. We deal with the costs to rail directly below, but within the electricity sector there have been few serious attempts to estimate the costs, largely because it is far from clear what the resulting infrastructure requirements might be. The roll-out would probably be substantially after 2020. Nevertheless, it would not be hard to envisage £5 billion before 2020, and a much larger sum afterwards, particular if the investment in the cars themselves is taken into account.

Energy efficiency

The demand side is likely to move increasingly from passive to active, and a significant component is investing in buildings through energy efficiency measures. Upgrading the housing stock is a major challenge in the next decade. Here there are lots of estimates – of both the costs and the benefits – which are frequently produced by vested interests. Upgrading the housing stock might be of the order of £20 billion.

Taking these five headings together, and assuming that the renewables target is met, it is not hard to get to expenditure of £200 billion. Much of this would be

back-end loaded in the period, so it might amount to, say, £10 billion a year in the early part of the next decade, rising to say £30 billion from around 2015. Were the full set of investments to transpire, the figure moves significantly north of £200 billion.

Table 5: Energy efficiency²⁴

Status	Requirement	Cost (£ billion)	Estimated timeframe
Likely add-on	Domestic energy efficiency measures	21	2016
TOTAL		21	

These estimates need to be set alongside the investment spend since privatisation in 1990. A number of gas-fired power stations have been built and there has been continuous replacement investment in the transmission and distribution networks. A very limited amount of wind generation has been built. In total perhaps £50 billion has been spent over the last two decades. While this investment has been significant, the main emphasis after privatisation has been on asset-sweating rather than investment. The most striking feature of this comparison is that the investment proposed is an order of magnitude higher than that of the past 20 years, and in very different financial circumstances.

Table 6: Aggregate energy infrastructure investment

Status	Requirement	Cost (£ billion)	Estimated timeframe
Likely minimum	Replacement requirement	42	2025
Likely minimum	Investment in the networks	65	2020
Likely minimum	Renewables	136	2021
Likely minimum	Energy efficiency	21	2016
TOTAL		264	

Transport

It has long been recognised that British transport systems are inadequate. In a small, densely populated country concentrated around its capital city, which includes a major financial centre, the importance of transport is obvious.

Transport infrastructure has been largely a public sector activity in the postwar period. In the 1940s even road freight was nationalised and rail and road networks have been in the public sector for most of the period. After a brief experiment with privatisation of the railways, public subsidy now dominates again, and the main network (Network Rail) is run by a not-for-dividend company. Airports were substantially privatised in the 1980s, with some exceptions, notably Manchester and Birmingham. Most of London’s transport has been publicly provided.

Public ownership and provision have not, however, been an unmitigated success, and as the initial privatisation of network infrastructures proceeded, the aim was to extend it across the whole sector. In addition to airports and rail

24 “Raising the SAP: Tackling Fuel Poverty by Investing in Energy Efficiency”, Consumer Focus, May 2009, see http://www.consumer-focus.org.uk/en/content/cms/Publications___Repor/Publications___Repor.aspx

privatisation, there have been less than happy experiences with air traffic control and the capital investments and maintenance of the London Underground.

The motivation for privatising the airports was investment. In the parliamentary debates in the run-up to the 1986 Airports Act, the debate was all about whether the private companies would drive through the perceived investment requirements. In the railways' case, the motives were more complicated. One objective was to promote competition, in part to weaken the rail unions. It was also a period in which roads dominated rail in the political realm and, although investment was obviously going to be required, there was little agreement about what the future should be: whether it was running the existing network more efficiently or preparing for a new rail era. A surge in demand followed, however, shifting the agenda towards investment and Railtrack's balance sheet proved inadequate to the task.

Taking each component in turn:

Rail networks and high-speed trains

Much of the investment requirement is about upgrading the existing networks, through stations and platforms, signalling and replacement investment. Electrification will be important too. The projected spend by Network Rail is £28 billion over the period to 2015. But even if this were executed quickly and effectively, new high-speed links will be needed. In part this is just to tackle the demand, but it is also for environmental reasons, not least to try and displace internal flights. There are a host of schemes that have been proposed, but at the core is a series of links between the major cities: London, Birmingham, Manchester, Edinburgh and Glasgow. Estimating the costs of high-speed lines depends very much on the spe-

25 "Control Period 4 Delivery Plan 2009", Network Rail, see <http://www.networkrail.co.uk/browse%20documents/StrategicBusinessPlan/Delivery%20Plan/2009/CP4%20Delivery%20Plan%202009.pdf>; "Britain's Transport Infrastructure – Rail Electrification", DfT, see <http://www.dft.gov.uk/pgr/rail/pi>; "Connecting Communities – expanding access to the rail network", ATOC, June 2009, see www.atoc.org/index.asp; "New Line Capacity Study – cost estimate", Booz Allen Hamilton (DfT), July 2008, see <http://www.dft.gov.uk/pgr/rail/researchtech/research/newline/costestimate.pdf>; "£4.5 billion proposal for High-Speed Rail extension", Arup, 23 July 2008, see <http://www.arup.com/united-kingdom/newsitem.cfm?pageid=11678>; "High Speed 2", Greengauge, June 2007, see <http://www.railwayforum.com/admin/project/uploaded-media/gg21-hs2.pdf>; "Rail review: getting the best for passengers", Conservative Party, see http://www.conservatives.com/News/News_stories/2009/02/Getting_the_best_for_rail_passengers.aspx

Table 7: Rail networks and high speed lines²⁵

Status	Requirement	Cost (£ billion)	Estimated timeframe
Minimum	Network Rail	28	2014
Minimum	Electrification, including GWML	1	2020
Likely add-on	Beeching lines re-opening	1	2020
Likely add-on	New line—high speed	39	2030
Alternative	New line—Maglev	142	2030
Alternative	New line—Conventional	34	2030
Alternative	Arup High Speed Hub	5	2019
Alternative	Greengauge High Speed 2 Proposals	11	2025
Alternative	Conservative high-speed plans	20	2030
TOTAL		69	

Notes: The DfT high-speed estimates are for lines which extend to Scotland. The other alternative estimates vary in their range and route. Other uncosted or additional (possible) investments: projected figures for investment in rolling stock are difficult to calculate as it is highly dependent on when the different types of stock come on line (there are significant differences in prices between electric and diesel units). Moreover, the projections which do exist may be due to change in the light of the recent announcement on electrification. However, given historical investment in rolling stock (see DfT, Transport Trends) it is difficult to imagine less than around £1 billion a year for the next decade – amounting to £10 billion

cific routes. The cost uncertainty is therefore considerable, but £40 billion is likely to be a conservative estimate.

London Underground

The London Underground is overcrowded and few would consider it fit for purpose. The PPP established in 2002 is coming to the end of its first seven-year period. The investment requirements are subject to considerable debate, but the total over the next decade amounts to at least £16 billion. If Crossrail is added then there is a further £16 billion to be invested.

Roads

Table 8: London transport²⁶

Status	Requirement	Cost (£ billion)	Estimated timeframe
Minimum	Crossrail	16	2017
Minimum	London Transport	16	2018
TOTAL		32	

After the great motorway building programmes in the second half of the 20th century, provision on the roads has moved from the old model of “predict and provide”, to what Glaister has described as “predict and don’t provide”.²⁷ In the last decade, road building has effectively ceased, as road transport demand projections point to steep rises. The capital spend to 2020 continued at current rates would be less than £20 billion. Yet the consequence will be greater maintenance, and this much higher figure masks delayed capex. The solutions to better management of existing resources – notably road pricing – have been rejected politically, except in major cities where there is no real option to expand capacity.

Airports and supporting services (air traffic control)

Table 9: Roads²⁸

Status	Requirement	Cost (£ billion)	Estimated timeframe
Minimum	National strategic road network	6	2014
Minimum	Regional Roads Programme	3	2014
TOTAL		9	

Notes: The £6 billion allocated to the Highways Agency for the national strategic road network includes funds for the widening of the M25. Other uncosted or additional (possible) investments: these figures do not take into account investment in roads by local authorities which could be of the order of £20 billion over the next decade to make up for the backlog in repairs and maintenance

In aviation, the state of the main airport, Heathrow, has at times been the subject of widespread criticism and even ridicule. The old terminals, the limits on space at the site, the inadequacies of the supporting infrastructure from road and rail, access to baggage handling – these have combined to make travelling by air too fre-

26 “Head of Terms in relation to the Crossrail Project”, DfT/TfL, November 2007, see <http://www.dft.gov.uk/adobe/pdf/165234/302038/headsofterms.pdf>; “Business Plan, 2008”, TfL (Mayor of London), see <http://www.tfl.gov.uk/assets/downloads/corporate/tfl-business-plan-09-10-to-17-18.pdf>

27 Glaister S, “Predict—but don’t provide?: Underinvestment in the Transport Infrastructure”, *New Economy*, 6:3, September 1999, 161-168

28 “Britain’s Transport Infrastructure”, Department For Transport, January 2009, see www.dft.gov.uk/pgr/roads/network/policy/motorways/motorways.pdf

quently difficult and unreliable. This has improved recently through the completion of one of Europe’s largest privately funded transport infrastructure projects, Heathrow Terminal 5.²⁹ This development highlights how Britain’s decrepit infrastructure can be successfully improved without public money.

Despite this, Heathrow is still bursting at the seams, and this points towards radical options: a big expansion, including a third runway; an alternative London airport; and/or a radical reduction in demand through a combination of pollution taxes, high-speed rail alternatives and a reduced hub role. The 2003 aviation white paper, *The Future of Air Transport*, set out a framework for airport development, including a new runway at Stansted. Its estimates of the costs of new runways at Heathrow and Stansted are around £10 billion. A new airport to the east of London might cost £40 billion. The following table provides an estimate of the investment needed in air transport infrastructure based on current government policy.

The costs of failing to meet transport demand, in particular the link to economic

Table 10: Air transport³⁰

Status	Requirement	Cost (£ billion)	Estimated timeframe
Minimum	Heathrow third runway – hub airport	7	2020
Minimum	Stansted second runway – spoke airport	3	2020
TOTAL		10	

Notes: Other uncosted or additional (possible) investments: i) Thames estuary airport: although there no official figures available, a figure of £40 billion is regularly quoted.

growth, were extensively researched in the Eddington Report. Combining the components listed above yields more than £100 billion. Set against the historical capex spending this is a considerable ramping up of investment. Rail network investment in the 1990s was £1-£2 billion per annum, rising after 2000 towards £4 billion per annum; road network investment was even less.

Table 11: Aggregate transport investment

Status	Requirement	Cost (£ billion)	Estimated timeframe
Likely minimum	Rail networks and high speed lines	69	2030
Likely minimum	London transport	32	2018
Likely minimum	Roads	9	2014
Likely minimum	Air transport	10	2020
TOTAL		120	

29 Mott MacDonald “BAA Heathrow – An official T5 report for the aviation community” <http://www.airport-business.com/wp-content/uploads/docs/T5-official-report-part-1.pdf> p21; <http://www.design-build-network.com/projects/terminal-5-heathrow/>

30 “The Future of Air Transport”, DfT 2003, see <http://www.dft.gov.uk/about/strategy/whitepapers/air/> and BAA – FAQ’s, see <http://www.baa.com/>

Communications

The privatisation of BT was motivated by the desire to finance the System X exchanges proposed by the nationalised company in the early 1980s. The project passed the Treasury investment tests, but with the deep recession in the early 1980s

and the Medium Term Financial Strategy, it could not, or would not, pay. Privatisation was designed to create a *private sector borrowing requirement* – to use a private balance sheet to raise the relevant sums.³¹

By the 1990s, the early model of a private BT was challenged by the technologically revolutionary situation. It became fashionable to see communications as distinct from conventional infrastructures. It was denied that communications were characterised by natural monopoly: there could be competing networks. Broadcasting and the web converged, and governments and regulators lagged hopelessly behind the technology.

As the consequences of the information revolution in the last three decades have begun to settle down, it has become obvious that there remains a basic network – broadband – and that access to this network plays an analogous function to that of the electricity network. It has become a primary social good.

Table 12: Communications³²

Status	Requirement	Cost (£ billion)	Estimated timeframe
Minimum	Nationwide roll-out of Fibre to the Cabinet/Very High Speed DSL (FTTC/VDSL)	5	2018
Alternative	Nationwide roll-out of Fibre to the Home/Gigabit - Passive Optical Network (FTTH/GPON)	25	2018
Alternative	Nationwide roll-out of Fibre to the Home/Point to Point (FTTH/PTP)	29	2018
TOTAL		5	

Notes: Other uncosted or additional (possible) investments: i) Next generation mobile networks: Digital Britain included the aim to expand super fast mobile broadband networks but official estimates do not exist as with fixed line networks. The investment needed could be as much as £2 billion over the next decade. ii) Royal Mail: the modernisation of Royal Mail will require significant investment over the next decade

It has also become apparent that liberalisation and competition have not placed Britain in a satisfactory position relative to its competitors, and that the development of fast broadband has a considerable way to go. The Digital Britain report represents a step in the direction of providing the required investment.³³

The scale of this investment depends on the ambition. If fibre access were to be provided on a national basis, it would cost up to £30 billion. If, however, cheaper, lower performance options are utilised, in particular providing fibre to street cabinets only, the costs would fall to around £5 billion.³⁴ Putting a total on other communications infrastructure is even more difficult: it is carried out by a large number of firms, and includes the full ambit of mobile, internet and broadcasting services. Together with broadband, the total is likely to be well in excess of £50 billion.

Water

The water industry was privatised in 1990 with an explicit objective to increase investment to catch up with the perceived failures in the public sector, constrained by the macroeconomic framework. The role of the private balance sheets was clear – indeed, to give the private borrowing for investment momentum, the companies were provided with a cash injection, the “green dowry”.

The initial assumption was that it would take around ten years to catch up the nationalised industry backlog. The gearing would rise to finance this and then a new steady state would be established. In practice this early assumption was falsi-

31 Helm D, “Making Britain More Competitive: A Critique of Regulation and Competition Policy”, *Scottish Journal of Political Economy*, 48:5, 471–87, 2001

32 “The costs of deploying fibre-based next-generation broadband infrastructure”, Broadband Stakeholder Group (BSG), September 2008, see http://www.broadbanduk.org/component/option,com_docman/task,doc_view/gid,1036/Itemid,63/

33 “Digital Britain, Final Report”, Department for Business Innovation and Skills and Department for Culture Media and Sport, June 2009

34 Caio F, “The Next Phase of Broadband UK: Action now for long term competitiveness. Review of Barriers to Investment in Next Generation Access Final Report”, Department for Business, Enterprise and Regulatory Reform, September, 2008

fied within a very short time. EU directives (especially, initially, the bathing waters directive) raised the investment costs substantially.³⁵

The capex spend is about £4.5 billion per annum, and the recent draft determinations of the periodic review for 2010-15 indicate that this will continue at £4 billion per annum. Specific large investments like the Thames Tideway, an infrastructure project intended to improve the capacity of London’s sewerage system and prevent sewage overflows, will probably push the number up.

Table 13: Water and sewerage networks³⁶

Status	Requirement	Cost (£ billion)	Estimated timeframe
Minimum	Price Review (PR09) determinations	23	2015
Likely add-on	Anglian Water	3	2020
Likely add-on	Severn Trent Water	3	2020
Likely add-on	Thames Water	6	2020
Likely add-on	Yorkshire Water	2	2020
TOTAL		37	

Note: Investment plans include the beginning of work on the Thames Tidewa

To these numbers, the cost of flood defence needs to be added. The Pitt Review of the floods in 2007, together with work by the Environment Agency, indicate a required spend of £8 billion for the next decade.³⁷

Table 14: Flood and coastal defences³⁸

Status	Requirement	Cost (£ billion)	Estimated timeframe
Minimum	Flood and coastal erosion risk management	8	2020
TOTAL		8	

Table 15: Aggregate water investment

Status	Requirement	Cost (£ billion)	Estimated timeframe
Likely minimum	Water and sewerage networks	37	2020
Likely minimum	Flood and coastal defences	8	2020
TOTAL		45	

Adding it all up

The numbers are obviously very uncertain, but this should not prevent the rough overall picture emerging. The total – once the likely add-ons are conservatively included – comes to around £500 billion, or £50 billion per annum for the coming

35 CEC, 2006

36 “Future Water and Sewerage Charges 2010-2015”, Draft Determinations, Ofwat, see http://www.ofwat.gov.uk/pricereview/pr09phase3/det_pr09_draft_full.pdf; “Strategic Direction Statement 2010-2035”, Anglian Water, see <http://www.anglianwater.co.uk/about-us/statutory-reports/strategic-direction>; Severn Trent Water, “Strategic Direction Statement 2010-2035”, December 2007, see <http://www.stwater.co.uk/server.php?show=ConWebDoc.3295>; “Strategic Direction Statement 2010-2035”, Thames Water, September 2007, see <http://www.thameswater.co.uk/cps/rde/xchg/corp/ns.xsl/889.htm>; “Strategic Direction Statement”, Yorkshire Water, see <http://www.yorkshirewater.com/search.aspx?q=Strategic%20Direction%20Statement>

37 Pitt M, “Learning lessons from the 2007 floods: An independent review”, 25 June 2008

38 “Investing for the future flood and coastal risk management in England: A long-term investment strategy”, Environment Agency, see <http://www.environment-agency.gov.uk/research/library/publications/108673.aspx>

decade. Such an amount needs to be added to the investment requirements in the public sector infrastructure –notably schools, hospitals and public sector IT networks. There are upgrades for police, social security and defence infrastructure as well. The sectors considered here form only part of the total picture. The bits left out include mobile networks and masts, air traffic control, postal services, and many more. These all add to the total. The aggregate presented here is therefore almost certainly a conservative one.

Table 16: Summary table

Sector	Cost (£ billion)
Energy	264
Transport	120
Communications	5
Water	45
TOTAL	434

4

How can it be financed?

Although particular components of the aggregate presented above may be capable of postponement and costs may fall for some items, the advantage of looking at this in the round is that it starkly illustrates the investment problem facing the UK economy over the next decade. Where exactly is £500 billion going to come from? How will it be financed?

That financing cost in turn depends upon the cost of capital, and that in turn depends on the allocation of equity risk. A 1% change in the cost of capital on the total programme of £500 billion is worth £5 billion per annum. Hence a great deal rides upon whether the regulatory system and the role of government are designed to hold down the cost of capital.

In the conventional approach to calculating the cost of capital, the capital asset pricing model (CAPM) is used. This provides a useful framework on which to hang the various components. There is first the cost of debt and the debt premium. The cost of debt is taken as the rate of interest on government bonds or gilts, which is a proxy for the pure cost of time and hence a riskless rate. To this is added the risk premium of the specific company or project.

“Where exactly is £500 billion going to come from? How will it be financed?”

From the discussion in chapter 3, we established that the return on government bonds is no longer riskless. As sovereign debt expands relative to the tax base and as a

proportion of GDP, it can be downgraded by rating agencies, and eventually there can be a reluctance to lend at all. The risk that governments will resort to inflation further undermines confidence. The deficits themselves can raise the cost of capital not just to government, but also to infrastructure. This in itself could be worth as much as 1% in due course, although in 2009 the real interest rate is below 2% which is, arguably, the long-run rate, reflecting the underlying productivity growth of the economy.

The debt premium added on top of the riskless rate depends crucially on the role of government and regulators. Where the Government offers guarantees, as in the case of the London Underground and Network Rail (and increasingly for PFI as well), the risk on debt default is transferred to the taxpayer, and hence the premium should be close to zero (though, of course, the risk itself remains).

The second main part of the CAPM calculation is the cost of equity. This comprised the return on a diversified portfolio of equity, multiplied by the beta coefficient, which is measured by the volatility of the specific investment to the index. The equity risk premium on the market has traditionally been around 7%, but since the abolition of exchange controls, financial liberalisation, and the dotcom boom, it has at times

been much less. Indeed, at the limit, some have argued that almost any risk can be diversified and that the equity risk premium should fall in line with the globalisation of financial markets.

The CAPM calculation of the cost of capital requires one further step: to introduce a gearing assumption to represent the balance of debt and equity. For normal commercial companies, this is represented by what the company has chosen. But for infrastructure and utilities, where government and regulators allocate risk through regulatory rules and long-term contracts, this is more complex.

The RAB and the role of debt

The role of debt in utilities and infrastructure is intimately related to the time-inconsistency problem identified above. Given that much of the capital cost is sunk, fixed and long-term, once the capex is completed, there is an incentive to expropriate the companies by forcing prices to marginal cost. That, in turn, undermines investment incentives, and the solution is to guarantee *ex ante* that the average costs will be paid *ex post*, so that the value of the investment is recouped and a return on it earned.

In the private sector, the usual mechanism is some form of long-term contract. In the regulated utilities the answer is the regulatory asset base (RAB). The RAB is a number which represents the past investments, comprising what investors paid when the assets were originally privatised, plus the completed efficient capex since then, adjusted for depreciation.

Once assets are in the RAB, there is nothing that management can do to change their value. The RAB is an accounting number, protected by the duty that is placed upon regulators to finance the functions of the business, including the RAB. Understood in this way, the equity risk in the RAB for the company is zero – it has been transferred to the customers who are compelled to pay for the RAB (or, in the case of government guarantees and subsidies, to the taxpayers).

“The return on government bonds is no longer riskless”

This has a radical implication. If the RAB is guaranteed, it can be financed by debt, and that debt in turn is effectively guaranteed through the duty-to-finance functions. The cost of the RAB should therefore be very close to that of government borrowing. Indeed, were investors to lose faith in the creditworthiness of government bonds, the RAB might actually become lower risk because investors have physical assets to fall back on. In a period of inflation, this could be especially valuable security.

The RAB is a concept familiar to the regulated utilities. It is less widely known across the rest of the infrastructure. Consider, for example, electricity generation. We identified in chapter 5 that the renewables programme might cost around £100 billion by 2020 and the nuclear programme around £30 billion by 2030. In each case the sunk costs are large, and as a result there is a big gap between the average and the marginal costs. In any normal competitive market, there would be a long-term contract between customers and shareholders: the latter would sink the capital on behalf of the former, on the contractual understanding that the former would pay.

In the case of renewables there is such a contract: the Renewables Obligation. But it is incredibly inefficient, making it one of the most expensive renewables support

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mechanisms in the developed world. In the nuclear case, the assumption must be that the companies consider they will have enough market power to guarantee that they will recoup their sunk costs. Historically this has not been the case for private nuclear investments. In the public sector, as in France, taxpayers absorb the risk.

Were the sunk costs of renewables and nuclear to be placed within a RAB, these costs would – once the projects are completed – attract the cost of debt only. The impact on the cost of capital would be radical.

Generalising the RAB

Particular RABs can be thought of as guarantees that the sunk costs of particular projects can be recovered. The concept can, however, be generalised to represent the contractual relationship for infrastructure more generally. It is the commitment by future customers and generations to honour the investment made now on their behalf. It is in their (future) interests, since it ensures that they get a fit-for-purpose infrastructure

“RABs fully financed by debt would be significantly less expensive than the current arrangements, easily lowering the cost of capital by 1% and in some cases several percentage points ... this is worth billions”

and with it a decarbonised economy. They, in the future, incentivise us, in the present, to invest on their behalf.

On this basis, the RAB concept can be extended to include the decarbonisation project more generally – including the renewables, nuclear and CCS electricity generation. The obligations and levies which have been created on an ad hoc basis can

be given a solid foundation. This might be termed the Low Carbon Obligation.

The RAB could also be introduced for roads, instead of current customers paying for current investment on a pay-as-you-go basis out of general tax revenue, and much of the PFI programme could be regularised in this way too.

The RAB has an inherent advantage over the diversity of current arrangements: its clarity about time inconsistency reduces risk and hence the cost of capital. RABs fully financed by debt would be significantly less expensive than the current arrangements, easily lowering the cost of capital by 1% and in some cases several percentage points. As indicated above, this is worth billions.

This is not financial alchemy. Time-inconsistency risk is a price paid for the lack of commitment – a failure to be clear about commitments. It is a deadweight welfare loss, involving a higher cost for the same capital investments.

Equity risk is not abolished as a result, however, and it remains extremely important to ensure that the carrying out of the capex is subject to efficiency incentives. Doing large and small-scale capex has historically been a serious management challenge, and governments have proved particularly inept at efficient investment. The RAB model ensures that, once completed, efficient capital projects are transferred into

the RAB. It is a project exit for the developer. The project itself is run by equity-financed businesses with project finance until it is sold into the RAB. The greater the certainty about the RAB, the lower the project finance costs too.

The RAB and savings

The RAB not only addresses the time-inconsistency problem, but it also provides a mechanism for channelling savings into investments – and hence contributes to the wider macroeconomic goal of sustainable consumption and savings paths. It is represented by RAB-based bonds. Given that infrastructure is either regulated by a direct pass-through of inflation (in the RPI-X formula) or by patronage and pricing power, investors in RAB-based bonds have an element of indexation to inflation. In effect, the RAB represents a low-risk, index-linked investment.

To date, infrastructure and utilities have been financed like other businesses and there has been little or no explicit RAB linkage. Bonds have been issued through the wholesale markets, typically with considerable pension and life-fund involvement. Equity has been raised either through rights issues (almost all in distress) or through private equity and infrastructure funds.

Pension and life funds clearly have a continuing role to play. They are the principal vehicles for savings. They have long-term liabilities, and utilities have long-term time-inconsistency exposures and long-lived physical assets. By encouraging savings for pensions – a major need for the British economy identified above – the RABs provide a means through which these can be channelled by financial institutions.

However there is scope to go much further, to directly connect with customers through retail investment vehicles. RAB-based bonds offer a low-risk opportunity for individuals to save, and thereby a low-cost source of finance for infrastructure. Infrastructure bonds could become a normal and substantial part of the portfolios of the wider population.

Governments can help this process in a number of ways. While the Government has undermined savings through monetary and fiscal policies since 2000, there have been contradictory mechanisms to encourage savings, such as ISAs. The obvious way of expanding retail investments in infrastructure and utilities is to allow a proportion of (expanded) ISAs in this category and to address the tax status of RAB-based investments.

There is a well-known general case for exempting savings from taxation. However, there are practical constraints on a rapid removal of the double taxation of earnings and then the returns on savings from that taxed income – not least the precarious state of public finances. The utilities and infrastructure areas represent a good case for a priority lowering of tax on investments for the reasons outlined in chapter 3. These

“The RAB not only addresses the time-inconsistency problem, but it also provides a mechanism for channelling savings into investments – and hence contributes to the wider macroeconomic goal of sustainable consumption and savings paths”

“Infrastructure bonds could become a normal and substantial part of the portfolios of the wider population”

activities are complementary and have powerful externalities. Thus the wider public benefit is not reflected in the prices, and the internalisation of these externalities from networks and low-carbon technologies merits a positive discrimination in their favour. A possible solution is to make interest on RAB-based bonds tax free for retail and pension fund investors.

The RABs and the £500 billion

A generalised RAB approach to infrastructure and tax exemption for the interest on RAB-based bonds would radically alter the financing landscape for infrastructure. It may make the difference between delivering the bulk of the investment and a process of endless delays, rescheduling and postponement. The latter would in turn have considerable effects on the competitiveness of the economy as a whole.

“The wider public benefit is not reflected in the prices, and the internalisation of these externalities from networks and low-carbon technologies merits a positive discrimination in their favour. A possible solution is to make interest on RAB-based bonds tax free for retail and pension fund investors”

Again some ball park numbers help to examine what is feasible. Suppose the cost of capital under the existing RPI-X regime is applied. Assume a post-tax real “going rate” from the regulators is around 5%. On £500 billion, this amounts to £25 billion per annum. The cost of the RAB should be the long-run cost of government bonds plus a small premium. This might be, respec-

tively, 2% and 1%. This reduces the cost of capital from 5% to 3% for the RAB component.

The financing cost is still a large number. It is merely illustrative and may be higher. Now we need to set this against the benefits, and the need to increase the savings ratio (and reduce consumption). It is highly implausible to suggest that the costs of the current state of the infrastructure – or, worse, the deficit infrastructure in 2020 if the investment does not take place – would be less than the financing cost. Estimates of the costs of total transport delays alone are considerable; estimates of the costs of climate change are considerably higher too.

In terms of the savings contribution, it was suggested above that the savings ratio may in any event have to rise to perhaps 10%. Even at a more cautious 7%, that represents around £100 billion per annum on the basis of the current GDP. Not all that savings will or should go into infrastructure, but it nevertheless indicates that the task of funding the infrastructure spend over ten years, though tough, is not an impossible one.

These ball park numbers are not meant to do anything more than test the plausibility of funding the infrastructure required. Yet it is important to recognise that even quite wide variance in these numbers will still make them add up. There is therefore a package of reforms that simultaneously addresses the chronic undersaving in the British economy, the large investment needs for infrastructure, the solving of the time-inconsistency problem, and the direct involvement of retail investors. Its ultimate logic is that pension and other longer-term transfer payments will be made from real physical assets which the current generation has created for future generations, so that they have an economy which can pay its older, retired community.

5

Conclusion

The economic crisis has raised fundamental questions about the ‘British economic model’, based upon high consumption and high borrowing. At the macro level, it has been argued that it would be better to focus on investment rather than consumption, creating assets to set against the debt. And among investment opportunities, infrastructure has considerable merits, not least because it increases productivity and competitiveness, as well as social inclusion.

The scale of the required infrastructure spend is potentially enormous. Crude ball park estimates provided here point to perhaps £500 billion by 2020. It is also clear that the Government will have little money to pay for it and that the cost of capital makes a big difference – every 1% premium equals £5 billion per annum.

In order to meet this total while minimising the cost of capital, the crucial issue is for the Government to commit to investors that their investments will be rewarded. This needs to be credible. The best way to do this is through the RAB; and if the commitment is credible, the RAB can be debt-financed. If the RAB is appropriately protected through regulation, the financing cost of the full infrastructure investment programme may be in the range of £10-£15 billion per annum for the eventual total RAB, to which the project finance for assets in the course of construction needs to be added – large but manageable, especially if the funding is linked to an expanded investor base, including not only pension funds but retail investors too.

The infrastructure programme not only improves overall economic performance, but fits with a recovery programme based on savings rather than consumption. Demand is maintained, but the inevitable borrowing is matched by assets created on the national balance sheet.

But such an investment programme carries risks too: if the current regulatory regime remains, and there is a lack of clarity about the RAB and the protection of sunk assets, then the cost of capital will be correspondingly (much) higher. Putting political and regulatory risk onto private investors is (very) expensive, with the result that much of the infrastructure investment may not take place. Continuing on a consumption-based approach to the economic crisis, and the current approaches to infrastructure regulation and finance will partly result in more of the same – infrastructure that is not fit for purpose. The result will be lower productivity and competitiveness and less future wealth to pay for public services and pensions.

The choice is clear, as are the consequences. The economic crisis can prove the catalyst to a more imaginative approach to infrastructure – holding up demand, creating jobs and providing future generations with a set of assets. The Victorians did it: the current generation needs to repeat it.

SECTION 2

Towards an integrated infrastructure finance policy

James Wardlaw

To meet our infrastructure requirements finance needs to be readily available, provided over long periods and accessible at low cost. The main thrust of this section assesses how Government can ensure that these conditions are met through improved and integrated policy, regulation and institutions.

6

State of the UK infrastructure finance market

In the UK there are three relatively distinct parts to the infrastructure finance market. Each part gives rise to certain issues that affect the availability, maturity and price of debt and equity finance.

- 1 Private Finance Initiative (PFI) and Public-Private Partnership (PPP) projects** – at 13th August 2009, 911 such deals have reached financial close.³⁹ These are essentially non-recourse project lending against a government or government-related income stream.
- 2 Contracted but not regulated projects** – for example, the M6 toll road, renewables financing and new railway rolling stock orders.
- 3 Regulated companies with corporate (as distinct from project) level financing** – for example, the infrastructure investments made by the big six energy supply companies as part of their RABs.

Equity finance

With infrastructure the financing challenge is predominantly, but not exclusively, a debt financing problem. That is to say, companies are generally having more trouble borrowing sufficient funds at the right price for infrastructure projects to take

“Companies are generally having more trouble borrowing sufficient funds at the right price for infrastructure projects to take place”

place. In contrast, the equity finance market is holding up comparatively well.

The equity finance market is in a better position primarily because there are a large number of institutional investors that have

recognised infrastructure equity investments as a source of inflation-linked, long-term and stable cash flows. This phenomenon shows no signs of reversing and so at present there is still a large amount of equity finance available for infrastructure projects. There are, however, a number of factors that might jeopardise the availability of this equity finance.

First, institutional investors are constantly evaluating the relative returns available on different types of assets. The target equity returns demanded of infrastructure investments are still in the process of being repriced in relation to

³⁹ <http://www.partnershipsuk.org.uk/PUK-Projects-Database.aspx>

the returns available on senior debt (which is less risky because senior debt must be repaid before other creditors receive any payment) and other prior ranking (to equity) elements of the capital structure. This repricing has yet to be completed.

Secondly, there is more operational risk and a stronger correlation to wider economic conditions than previously anticipated. For example, the M6 Toll Road has seen traffic fall by nearly 12% in the first half of 2008 compared to the previous corresponding period.⁴⁰ One recent assessment of the outlook for the European infrastructure sector by Moody's concluded, "all transport infrastructure issuers are expected to see lower volumes in 2009 and flat to negative growth in 2010". The impact of prevailing economic conditions on the profitability of infrastructure projects is likely to reduce equity financing.

Thirdly, when the balance sheet is exhausted, recent events in the water sector have illustrated that the marginal source of capital is equity. Moreover, the weighted average cost of capital approach of all regulators disincentivises the raising of equity financing because the marginal cost of equity is higher than the marginal (post tax) cost of debt – equity injections have been made by shareholders into Southern, Anglian and Kelda. The alternatives to further equity calls on shareholders are debt-only mutualisation (like Network Rail out of Railtrack's balance sheet exhaustion, and Glas Cymru) or pay-as-you-go charging.

Finally, although construction and contracting companies still appear keen to support their pipelines of construction work with equity debt, some analysts question how long this can continue in the face of the current downturn.

Together these factors mean that although the equity finance market has been holding up relatively well for infrastructure projects, potential problems are emerging which may reduce the availability of equity finance.

Debt financing

Turning to the market for debt finance (as distinct from equity finance), it is helpful to split the issue into its three inter-connected components: availability, maturity and price.

Availability

In the UK, the recent transactions for the M25 and the Greater Manchester Waste Disposal Authority's PFI project both showed that debt financing is available for some well structured deals involving infrastructure. However, the general availability of debt finance for infrastructure is likely to have fallen quite significantly. In the UK, the two largest public sector infrastructure banks, Depfa and Dexia, have largely withdrawn from the market.

Unfortunately, we may never know the extent to which debt finance availability for UK infrastructure projects has declined. With regards to Depfa and Dexia,

“To meet our infrastructure requirements finance needs to be readily available, provided over long periods and accessible at low cost”

“The general availability of debt finance for infrastructure is likely to have fallen quite significantly”

40 www.infra-news.com, 30th July 2009

Box 1. Monoline insurers

Monoline insurers are financial institutions focused solely on insuring bond issuers such as municipal governments against default. Bond issuers buy this insurance to upgrade the credit worthiness of their bonds, making the overall cost lower by giving confidence that the insured security would be paid in full.⁴¹ The first monolines were set up in the US in the 1970s, covering municipal and corporate bond issues.

The credit crunch hit financial markets very hard, placing huge stress on the monolines as they covered the rising tide of bond defaults. Some lacked sufficient capital to cover their liabilities adequately. Several had their credit ratings reduced, effectively downgrading them to junk status.⁴² This has an impact on many of the issuers of bonds, such as local governments, because the monoline is no longer able to use its A-rated status to turn its debt into AAA by guaranteeing it.⁴³

This is important for infrastructure financing in the UK because these institutions can no longer play a role in reducing the cost of finance for projects. That the British and American governments have largely taken the place of the monolines in using their AAA ratings to prop up the capital markets has profound implications for the role of government in financing or guaranteeing bonds or other debt raised to deliver infrastructure projects.

Another consequence of extensive monoline involvement in the infrastructure financing market was the obstruction of the transmission mechanism between pension savings and infrastructure projects. This was the result of monoline insurers, due to their relative expertise, effectively discouraging institutional investors from establishing credit analysis teams focussed on infrastructure projects.

“Debt financing is, with some exceptions, available for much shorter periods than it once was”

reliable figures are unavailable because they acquired much of their exposure through private placements. We can, however, show the potential scale of the reduction in debt finance availability due to their withdrawal from the market. If we look at Depfa alone,

which is part of Hypo Real Estate, it was recently nationalised by the German Government with liquidity support and guarantees worth some €102 billion. At the end of 2008, the bank had total loan exposure of €294 billion to public sector and infrastructure projects.

In addition to Depfa and Dexia, the other previous suppliers of debt finance such as the monoline insurers have also largely exited the market. This raises the question as to what will replace them, especially given the constraints of recapitalisation and the Government Asset Protection Scheme on the ability of Lloyds and RBS to lend to infrastructure projects. The European Investment Bank (EIB) is becoming an increasingly important participant. The Prime Minister recently called on the president of EIB to increase its lending to businesses for critical infrastructure projects, including transport and energy projects, by €50bn over the next two years. In subsequent sections we will see whether this in itself is sufficient or whether other actors are needed to ensure that enough project debt finance is available.

41 “Advantages of the monoline structure”, Association of Financial Guaranty Insurers (not dated); <http://www.afgi.org/monoline.htm>

42 “S&P cuts ACA to CCC junk, acts on 6 bond insurers”, Reuters, 19th December 2007; <http://www.reuters.com/article/bondsNews/idUSWNA118620071219>

43 “Ambac rating downgrade threatens further pain”, *New York Times Dealbook*, 18th January 2008 <http://dealbook.blogs.nytimes.com/2008/01/18/ambac-rating-downgrade-threatens-wide-r-pain/>

Maturity

Debt financing is, with some exceptions, available for much shorter periods than it once was (most banks do not want to lend for longer than seven years) and typically shorter than the life of infrastructure assets. It is no longer possible to finance projects and concessions with bank debt of this shorter maturity. This exposes infrastructure project developers to refinancing risk because their debt matures earlier than it used to.

Price

Debt spreads have increased significantly since the credit crunch, although they have been falling this year. Consequently, judgements about the value for money of private sector versus public sector gilts-based financing have become more difficult. Essentially, the key question for a procuring authority is what are we getting for the incremental cost of financing over and above the cost of government borrowing through gilts? This was a much easier question to answer when the differential was 60 basis points per annum than when it is 250 basis points or higher.

“ there is a stronger case to be made that these issues are structural and that we will not revert to the heady days of abundant liquidity ”

It is tempting to think that the issues are temporary; that the market will come back; that banks will heal their balance sheets; that capital market investors will become less risk averse and bring spreads in from anomalous levels. But there is a stronger case to be made that these issues are structural and that we will not revert to the heady days of abundant liquidity which encouraged the headlong pursuit of incremental yields irrespective of risk. Against this backdrop, we must reflect on the adequacy of the existing institutional set-up in this country to deliver the financing of infrastructure that we need and the role that the Government should play.

7

Improving the institutional structures

There is a legitimate long-term role for government in infrastructure financing. The existing institutional structures of government intervention do, however, need updating. In the UK we have tried many different approaches before on a project by project basis with no consistency. This must change.

What we have tried before in the UK

“There is a legitimate long-term role for government in infrastructure financing. The existing institutional structures of government intervention do, however, need updating”

- **Underpinning** – we have tried several variations on this theme. Underpinning is the idea that government in some form guarantees or uses its credit support to make the financing possible or at reduced cost. Examples include the 95% underpinning on the Tube PPPs; the offer of 60% underpinning on the M25 widening (which was not taken up), the schedule of minimum termination amounts on Skynet 5 which exceeded principal and interest on the senior debt in all circumstances, and the Docklands Light Railway extension to Woolwich Arsenal deal in which TfL gave senior lenders the right to put 75% of the senior debt back to TFL once construction had been completed satisfactorily.
- **Credit Guaranteed Finance (CGF)** – CGF was identified by the Treasury in its PFI policy document *Meeting the Investment Challenge* in July 2003 as an opportunity to reduce the cost of PFI debt financing. It recognised two elements of debt pricing: a risk premium and a funding premium. The idea behind CGF was that the Treasury retained the funding premium because it had a much cheaper cost of funding than any other debt provider. The risk premium was paid to monoline insurers. But even before the monoline business model died, so had CGF because no incentives were offered to departments and other PFI sponsoring authorities to share any of the funding benefits – the Treasury captured all of the funding premium.
- **Direct lending** – done through the Treasury’s new senior debt lending unit, the Treasury infrastructure finance unit (TIFU). This lending has been utilised by projects such as the Greater Manchester Waste Disposal Authority’s PFI project.

We also have a proliferation of different government funded bodies involved in infrastructure.

Table 17. Government and government sponsored bodies involved in infrastructure financing in the UK

Organisation	Year founded	Function
Public Works Loan Board (PWLB)	1793	"PWLB's function is to lend money from the National Loans Fund to local authorities and other prescribed bodies, and to collect the repayments." ⁴⁴
Centre for the Protection of National Infrastructure	1989	Provides integrated security advice to companies and agencies providing the UK's national infrastructure. ⁴⁵
Partnerships UK (PUK)	2000	Succeeded the Treasury Task Force, which had been established in 1997 to reinvigorate the PFI programme.
Infrastructure Planning Commission (IPC)	2008	Established under the Planning Act 2008 as the new authority granting development consent for nationally significant infrastructure projects. ⁴⁶
The Treasury Infrastructure Finance Unit (TIFU)	2009	To "consider applications for Treasury loans to PFI projects, negotiate the terms of any such loans and monitor and manage loans once made." ⁴⁷
Infrastructure UK	2009	To "identify the country's long term infrastructure needs across a 5-50 year horizon, take stock of where current plans are taking us in the long term and analyse where more could be done, considering the interdependencies between different types of infrastructure." ⁴⁸

The latest body to be created is Infrastructure UK which was announced in the *Building Britain's Future* report launched on 29th June 2009. This is intended to be an advisory body to be developed by Lord Mervyn Davies to identify the country's long-term infrastructure needs. Full details of the new body and the appointment of a chair will be announced in time for the Pre-Budget Report, which is typically late November/early December.

In principle, Infrastructure UK should be welcomed if it does not resemble the much ridiculed Trans European Network Schemes project (Box 3) and is more like Infrastructure Australia (Box 2). The latter example is useful in the context of the more straitened public spending and borrowing environment we are about to embark upon: it would force a co-ordination and prioritisation across the relevant departments such as the Department for Business, Innovation and Skills (BIS), DfT, and DECC that otherwise have come together only on the three-yearly Comprehensive Spending Review cycles.

In addition to Infrastructure UK, another recent creation is the Treasury infrastructure finance unit (TIFU), which was established in March 2009 and is intended to be a temporary lender to PFI projects. There is also the Public Works Loan Board (PWLB), which had lent out £50.8 billion to local authorities for capital purposes at the end of March 2009.⁴⁹ The PWLB originated in 1793 and

44 <http://dmo.gov.uk/index.aspx?page=PWLB/Introduction>

45 <http://www.cpni.gov.uk/about/cpni188.aspx>

46 <http://www.communities.gov.uk/planningandbuilding/planning/planningpolicyimplementation/reformplanningsystem/planningbill/>

47 http://www.hm-treasury.gov.uk/d/ppp_tifu_letter_050509.pdf

48 *Building Britain's Future*, HMG, June 2009, p16; <http://www.hmg.gov.uk/buildingbritainsfuture>

49 <http://www.dmo.gov.uk/>

Box 2. Infrastructure Australia and the Building Australia Fund

In its first Budget in May 2008 the new Labor Government in Australia allocated A\$20bn (c £10bn) to its Building Australia Fund for national infrastructure priorities. These priorities were published in May 2009 after an extensive consultation process with the State governments. The Infrastructure Australia Advisory Council was established, under the chairmanship of Sir Rod Eddington, to bring together representatives from the Commonwealth and State governments and the private sector. Infrastructure Australia acts as the advisory board of the Building Australia Fund and is supported by an infrastructure coordinator, who leads an office of infrastructure coordination within the Ministry of Infrastructure, Regional Development and Local Government.

This new ministry brings together infrastructure spending and prioritisation at a national, state and local level. Interestingly, it does not encompass energy, water or broadband, which are part of separate ministries. Nevertheless, the remit of the Building Australia Fund is to “finance capital investment in transport infrastructure (such as roads, rail, urban transport and ports), communications infrastructure (such as broadband), energy infrastructure and water infrastructure”.⁴⁹

In the UK, it would be difficult to establish a single, broadly based department of infrastructure that cuts across departments such as transport (DfT); culture, media and sport (DCMS); or energy and climate change (DECC) to name but a few. A purely advisory body faces considerable challenges in the face of accounting officer responsibilities and other institutional constraints, but one which provided finance as well, like the Building Australia Fund, clearly would have attractions to those departments. It also serves to highlight that the financing of capital spending by local authorities in the UK is almost totally funded through the Public Works Loan Board.

since 2002 has operated as part of the Debt Management Office, an agency of the Treasury. Its customers are nearly all local authorities requiring loans for capital purposes. But it also has an illustrious history in infrastructure financing includ-

Box 3. Trans European Network Schemes (TENS)

TENS dates back to the EU Summit in Essen in 1994. It was an ambitious programme of physical infrastructure creation to underpin greater economic activity across Europe by improving roads, railways, and key electricity, telecoms and gas pipeline networks in the EU. Sixteen initial projects were adopted in 1996 and a further six in 2001. The three UK projects were:

- The Channel Tunnel Rail Link (now called High Speed One) between London St Pancras and the Channel Tunnel, which was seen as part of the high-speed train network linking Paris, Brussels, Cologne, Amsterdam and London
- The West Coast Main Line
- A road across the UK from Felixstowe/Harwich to Holyhead linking Ireland and the Benelux countries. This, perhaps unsurprisingly, has failed to materialise

It is generally acknowledged that the TENS programme has failed to mobilise private sector funding on any scale.

⁴⁹ Building Australia Fund was established on 1st January 2009 by the Nation-building Funds Act; www.finance.gov.au/investment-funds/NBF/BAF.html

ing that of the Victoria Line. With a modest amount of retraining the PWLB could re-establish a capability to lend to infrastructure projects, particularly where there is a public sector interest.

The other body within the existing institutional architecture is Partnerships UK (PUK), which is 44.6% owned by the Treasury, 4.4% by Scottish Executive and the remainder by banks, insurance companies and other private sector companies.⁵¹ At present, PUK does not have the power to provide financial assistance to PFI projects through equity stakes or other means, a restriction introduced to prevent a conflict between providing financial assistance and advice. The original idea was that it would support a private finance unit in each of the relevant departments replicating the functions of the original Treasury Taskforce. The effectiveness of this decentralisation of responsibility also needs to be reviewed ten years on from the second Bates Review, which recommended the establishment of Partnerships UK.

This is not to suggest that these bodies are doing anything other than a professional job. But our institutional structures need updating and bringing together so that they deliver in a co-ordinated and strategic way. Infrastructure UK is a welcome development because it provides a basis for aligning long-term incentives with long-term priorities and needs. It is surely time to get away from a situation in which departments structure the financing of each project on a bespoke basis and move towards the financing of infrastructure needs through a single, public sector backed institution.

“our institutional structures need updating and bringing together so that they deliver in a co-ordinated and strategic way”

Are there any lessons to be learned from other countries, as well as Australia (Box 2)?

Ireland – National Treasury Management Agency (NTMA)

NTMA was established in 1990 to manage assets and liabilities on behalf of the Irish Government. Its remit has subsequently been expanded to include:

- The National Pensions Reserve Fund, which was designed to build up assets to fund public sector pension liabilities.
- National Development Finance Agency, which advises state authorities on the optimal financing of priority public investment projects by applying commercial principles. NTMA also has the power to raise funding of up to €5 billion to finance infrastructure projects and is responsible for the procurement of projects (excluding roads and rail).
- The newly created National Asset Management Agency will be a commercial semi-state entity under the governance, direction and management of NTMA. It is essentially the Irish “bad bank” created to house the property-related lending of the Irish banks.
- NTMA also borrows on behalf of the Housing Finance Agency and acts as Ireland’s agent for the purchase of carbon credits.

In a UK context, its activities would comprise those of the Debt Management Office, Partnerships UK and the Asset Protection Agency.

⁵¹ <http://www.partnershipsuk.org.uk/>

Germany – KfW Bankengruppe

KfW is the promotional bank for the German economy set up by the Marshall Plan in 1948 for the reconstruction of Germany. It is 80% owned by the Federal Republic and 20% by the Länder. KfW has also played a significant role in the bank rescues, in the privatisation process and more recently in the German stimulus package which includes lines of credit for small and medium-sized enterprises and a guaranteed credit programme for larger enterprises. KfW has also played a major role in financing measures designed to tackle climate change.

The Federal Republic guarantees by law all existing and future obligations in relation to money borrowed, bonds issued, obligations guaranteed and derivative transactions entered into by KfW. It borrows approximately €75 billion per annum from the capital markets but its actual and contingent liabilities are not scored, i.e. its debt is not consolidated into that of the Federal Republic of Germany. Many countries in Europe look enviously on KfW's large, semi-captive balance sheet that is not classified as part of the public sector. Apart from being established sufficiently long ago to be exempt from subsequent rules such as ESA95, the key factors in achieving this status, and which any UK counterpart would need to satisfy, are:

- The commercial principles upon which KfW is managed and finance provided are the main reason that the Federal guarantee is unlikely ever to be called.
- The Government does not appoint any of the directors or exercise control over KfW management, although the finance minister heads the supervisory board on which the minister for economics also sits.

To deal with private sector financiers of infrastructure crying foul at the funding advantage of KfW, Germany reached a compromise with the European Commission and set up a legally independent, but still wholly owned, entity called KfW-IPEX Bank. This covers both infrastructure and export finance. A British equivalent of KfW-IPEX Bank would encompass the PWLB, Export Credit Guarantee Department, TIFU, Partnerships UK and the recently announced Infrastructure UK all under one roof.

Towards a UK Infrastructure Bank

Partnerships UK and the new Infrastructure UK are advisory bodies whereas TIFU and the PWLB have the power to lend. This is an important distinction, but all four are close to the Treasury. All are staffed with talented and experienced people with lots of senior level private sector experience with a public service “overlay”. A thorough analysis of whether these bodies should be combined into a single commercial organisation would be worthwhile. The prize is an institution which facilitates the introduction of private sector capital without crowding it out, finances itself with a government guarantee, aims to break even with any dividends reinvested, and whose liabilities do not score in the National Accounts but whose activities are defined by national priorities. The review led by Gus O'Donnell (when he was Permanent Secretary to the Treasury) of combining Customs & Excise and the Inland Revenue to create Revenue & Customs and bring tax and delivery closer together provides a useful precedent for the process.

A UK infrastructure bank formed on this basis should also be responsible for managing the Government's contingent liabilities and its shareholding interests in infrastructure. These include its shareholding in NATS air traffic control services and the debt guarantee to Network Rail (for which the Government now receives a guarantee fee of 80 basis points per annum).

Throughout this report the case is made for government intervention in the provision of infrastructure. Equally, there is a legitimate, low-risk role for government guaranteed senior debt funding as a "top slice" of the risk, with subordinated debt and/or equity taking the real risk. A comprehensive study by Standard & Poor's on recoveries in the event of project default reinforces this case. The study has not been published, but it underpins its analysis of PFI securitisations that have been issued. It estimates that in the event of default on a PFI project (which has not happened yet in the UK) the senior debt holders would recover on average as much as 85%, which could be collected within a stress period of 15 months. This suggests that if the Government takes the top slice of properly structured senior debt, while true equity or mezzanine capital takes the real risk of the project, this is a very low risk proposition that can reduce the overall cost of capital meaningfully.

There will undoubtedly be those who argue that an organisation of this nature will crowd out the private sector; that with the funding advantage that derives from a government guarantee, it would be substituting for the provision of private sector finance rather than adding to it. The governance arrangements would therefore be critical to ensuring that such an institution is utilising its financial capacity to facilitate and leverage private sector capital investment in priority infrastructure projects and providing the scale of support required. If that means that all the financing can be sourced from private sector organisations on terms which represent value for money, this would seem to be ideal. A single, government-sponsored body would be significantly more effective as a facilitator of priority infrastructure projects than any entity whose remit only extends to providing advice.

8

Reducing risk and recycling investment

One key challenge is to find a way to finance the construction phase of an infrastructure project before it becomes operational and cash flow producing. Pension funds and other institutional investors, either directly or indirectly through the infrastructure funds, do not as a general rule, want to take construction or development risk. Their interest is in cash returns derived from projects once operational or at least substantially “de-risked”.

The distinction between availability-based and demand-based revenues is important in understanding the risk for financiers. Optimism bias and poor forecasting have left many private sector equity investors wary of greenfield projects (new projects in a place or area where none has been before). The position in relation to the availability of project debt finance from banks is even worse – the project finance industry is a mere shadow of what it once was.

The lack of risk capital appetite for greenfield projects raises the question as to whether it is legitimate for government to step in. Although there may be concerns about government selecting the projects it will or will not support, it can underwrite

the wider economic benefits which ultimately are reflected in higher tax receipts. Its costs of capital are also lower and, in the absence of a private sector alternative, this can make the difference between a project going ahead or not.

Nonetheless, in these straitened fiscal times, we must give proper consideration to those more

“In these straitened fiscal times, we must give proper consideration to those more mature assets that the public sector might sell in order to free up funds for investment in greenfield projects”

mature assets that the public sector might sell in order to free up funds for investment in greenfield projects. The results of the Operational Efficiency Review, announced at the time of the April 2009 Budget, were a false start – this review did not create the right incentives for departments and their accounting officers to identify assets that could be sold and the proceeds reinvested. This applies both to the asset sales and the property components of the review. Two examples in the last year or so illustrate this point:

The councils that comprise the Greater Manchester Passenger Transport Authority developed ambitious and comprehensive congestion management plans, which included extensions to the Metrolink, congestion charging and a

number of other elements that were eventually rejected by a local referendum. They pitched for grant funding from the DfT Transport Innovation Fund. But at no stage in these negotiations with the DfT were serious attempts made to insist that the funding came from either selling equity in Manchester Airport (which these councils also own albeit in a slightly different configuration) or gearing it up and using the proceeds for their capital spending plans.

M25 widening/Dartford Crossing. In October 2005, the Highways Agency chose to launch a complex, on balance sheet design, build, finance, and operate project to widen most of the M25 to four lanes. This M25 deal has only recently reached financial close. Furthermore the Operational Efficiency Review stated that proposals to sell a concession in the Dartford-Thurrock Crossing over the River Thames would be brought forward in the 2010 Budget together with associated plans for additional capacity. Instead, it would have been much better to have sold such a concession (which is already collecting tolls) and the proceeds used for widening elsewhere on the M25. But the incentives were not present for the Highways Agency to do this.

There is some evidence to suggest that local authorities are recycling their capital rather better than central government departments. What is required is a proper set of incentives and an accompanying value-for-money methodology that would encourage departments to think broadly about which of their assets could be sold and the proceeds recycled.

It is clear that the capital markets should be the natural source of debt funding for mature infrastructure given the long-term, stable, essential and inflation-linked nature of the cashflows. Pension funds are the natural buyers of long-dated inflation-linked assets to finance long-term capital expenditure to match their liabilities. But several obstacles must be overcome, including accounting. We must recognise the capacity of accounting rules to discourage what is economically sensible in relation to inflation-linked financing. Under International Accounting Standard 39, it is very difficult to secure hedge accounting. Without hedge accounting, issuing RPI-linked debt, for instance, even if one has RPI-linked assets, will result in volatility in the profit and loss account. For privately owned companies with sophisticated shareholders, this is less of an issue, but for listed companies and for those such as Network Rail where there is considerable public interest, the prospect of having to explain this volatility in simple, easy-to-understand terms is daunting. This is not assisted by the different approaches to inflation-linked debt adopted by the main rating agencies, which is important because the downside of inflation-linked debt is that it rises in absolute/nominal terms. Regulated asset base (RAB) gearing will therefore rise faster with index-linked debt (assuming that RPI is >0).

9

Consistency across the regulators

We need to develop a more consistent approach towards the allowed return and cost of capital in the regulated industries. This will help us to meet the huge infrastructure financing challenge we face.

Why the UK regulatory finance model needs fixing

At the outset of each five-year regulatory cycle in each industry (and indeed some-time before), regulators gaze into the future with the help of the capital asset pricing model and an economics consultancy to try to determine the appropriate cost of capital. Hindsight is a wonderful thing, but regulators generally made two assumptions that the market took advantage of in the “dash for debt”:

1. Their gearing assumptions were too low

Regulated companies have traded at a premium to RAB by lowering their cost of capital through higher gearing and lower real interest rate costs than the regulator had assumed. They have done this in three ways:

- Increasing operating company leverage typically to 75%
- Building in an assumption to re-leverage rather than pay down debt with operating cashflow over time
- Adding a further layer of holding company leverage (outside the regulatory ring fence)

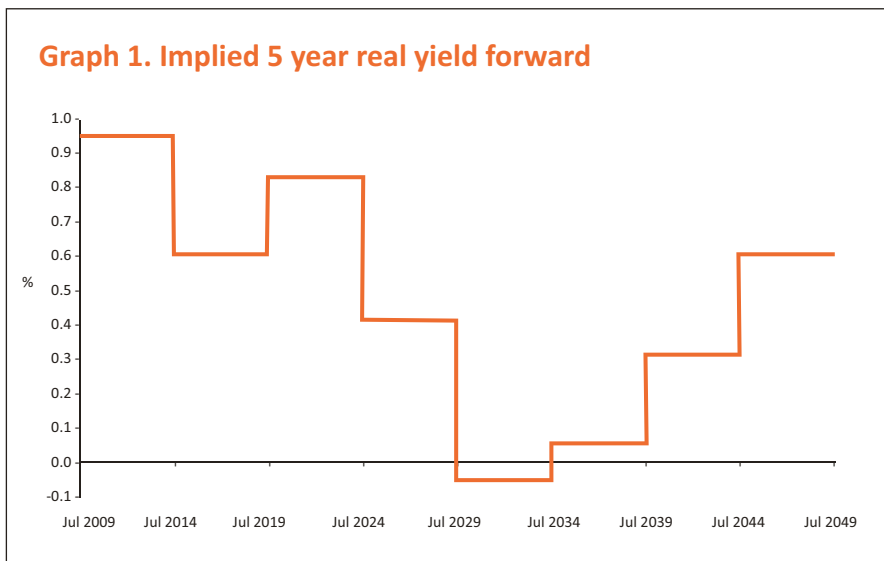
This additional leverage is then partially offset by assuming a higher cost of equity – appropriate because the risk to equity investors has increased.

Where there was also an ability to exit at a premium to RAB after a hold period, this would not typically include any condition about operating expenditure outperforming the regulators’ assumptions. The net effect of this financial engineering meant a subsidy flowing from consumers to shareholders in the form of higher bills than would otherwise have been required.

2. Real interest rate assumptions have been too high

The principle of financing long-term capital expenditure with debt that has more than five years to maturity is well accepted by regulators but, at the long end of the yield curve, real interest rates have been persistently lower than expected and furthermore the negative slope has encouraged borrowers to push for the longest possible maturities.

The chart below shows the market implied real yields five years forward. This illustrates the reward for expressing a view on future regulatory resets and the gain regulated companies can make for extending the maturity of their debt. This needs to be contrasted with the range of settlements by regulators which have been consistently much higher and have usually assumed a risk free (i.e. gilt) real interest rate of 2% or higher.

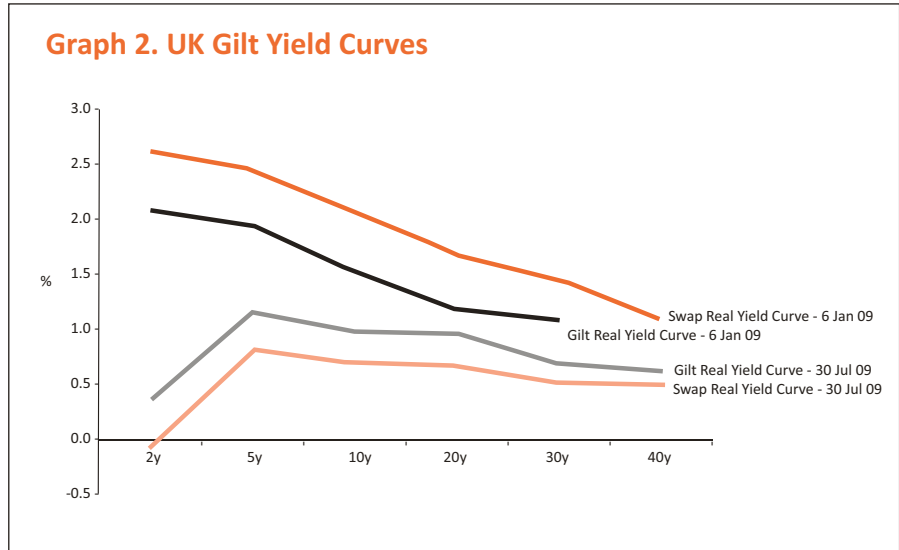


The plurality of capital structures championed in 2003-05 by Ofwat and Ofgem has been largely eroded by “dash for debt” and the takeover of a large number of listed companies, with the result that there are few listed companies left. The task of determining the appropriate cost of capital, in particular the β component, has been made more difficult by the limited number of listed companies with observable share price performance.

But a great deal has changed since 2007:

- The availability of debt is significantly constrained and so the gearing achievable is much lower than it was and possibly lower than the regulatory gearing assumptions.
- By way of illustration, the “staple” finance package offered by the vendor BAA’s banks to prospective bidders for Gatwick was £1.1 billion on a RAB of £1.75 billion or only 63%. The maturity of this facility was only for 18 months with an option to extend for a further 18 months, so it did not even cover the next regulatory control period.
- Credit spreads have widened significantly, but the underlying real reference rates – both gilts and swaps – are much lower, particularly at the shorter end of the curve. The £ swap yield curve is now below the gilt yield curve giving rise to attractive yields to investors on asset swap.

Regulators should adopt the alternative approach, actually used by the market, to prevent the volatility versus RAB in both listed company share prices and the premium/discount to RAB/RAV that have been seen when companies have traded in the M&A market.



Alternative approach

Step 1 - Regulators should determine the actual cost of debt achievable by the regulated companies in the market place based on the executable long-term cost of debt in the market with an appropriate allowance for the embedded cost of outstanding debt. If the companies choose not to lock in these levels, this risk is essentially borne by equity – the shareholders to whom management is answerable.

Step 2 - Regulators should determine the appropriate gearing levels by reference to specific debt sustainability metrics (which may correspond to particular rating categories, but should not be determined explicitly by the rating agencies as they are, in effect, at present).

Step 3 - Determine appropriate equity returns based on comparable returns available in the market for comparable risk.

Step 4 - The market then decides whether the company should trade at a discount or premium to RAB.

In addition to determining the appropriate allowed return for regulated industries, there are several related issues where regulators should develop a consistent approach, which will lead to a lower cost of capital:

- Indexing part of the allowed return as a means of reducing interest rate risk/embedded cost of outstanding debt. This is particularly important now that the yield curve has steepened and long dated issuance is more expensive.
- Real versus nominal – the significance of this issue has been highlighted recently by the volatility in RPI and other measures of inflation.

Most financing models contain future inflation assumptions of between 2% and 3%. Recent swings outside both ends of this range have caused debt/RAB covenants (typically expressed in nominal terms) to come under strain, which has encouraged shareholders in some highly indebted regulated companies to inject more equity.

Graph 3. UK Retail Price Index Inflation, July 2003 to July 2009

- **Financeability** – This issue arises because regulatory settlements provide companies with an allowance for interest payments as if all debt is index-linked – RAB accretes with RPI and a real weighted average cost of capital is applied to this. This means that the revenue receipts have the same profile as index-linked debt. Since the cash cost of nominal debt is greater than it is for index-linked debt, this means that companies with nominal debt have to find the cash funding from somewhere. Financeability payments are the generic term given to compensation payments to solve this short-term cash flow issue, which arises for those more highly leveraged companies with a significant portion of their debt on a nominal rather than index-linked basis. Each of the regulators has adopted a different solution to the issue, hence the need for consistency.

Consistency of RAB – the regulatory promise – is an important goal in itself. Greater consistency should lead to a lower cost of capital because understanding the nuances of each industry in each five-year cycle is not something that encourages investment in listed companies – capital market participants and analysts should not have to understand these minutiae.

Cost of capital is currently set by a combination of economics consultancies like CEPA, NERA and Oxera and negotiation takes place against the backdrop of the threat of referral to the Competition Commission. The Competition Commission is not able to perform this function in its position as “court of appeal” against regulators’ decisions, mostly because their decisions do not go to appeal. So the role must fall to either the Treasury or BIS. BIS comprises the former departments for innovation, universities and skills and for business, enterprise and regulatory reform and it is, after all, regulatory reform that is required. But the Treasury is central to determining how it all gets financed across the various relevant sectors.

“Greater consistency should lead to a lower cost of capital because understanding the nuances of each industry in each five-year cycle is not something that encourages investment”

10

Removing rating agencies from the regulatory architecture

The rating agencies have been criticised for their role in the banking crisis and are now under intense pressure from legislators and regulators around the world. Both the Financial Times (23rd July 2009) and The Economist (25th July 2009) have called for references to ratings in regulations to be removed, in order to weaken artificial demand for the use of ratings. Specifically, they are still embedded in the regulatory finance architecture. Indeed, the recent DfT proposals for reforming the framework for economic regulation of UK airports seek to entrench this further by making it obligatory for licensees to maintain an investment grade rating in line with a number of other regulated industries.

Standard & Poor's in particular has made two important "calls" in the context of infrastructure finance:

- It determined that the minimum debt service coverage ratio consistent with an investment grade rating for a standard PFI deal should not be below 1.20x.
- It published a report entitled "The Amazing Growth of Global Infrastructure Funds: Too Good to Be True?" in November 2006, in which it attempted to prick the bubble of an overheated market. It was largely dismissed at the time.

In both instances these were important interventions in the financing of infrastructure in this country and highlight the important role that the rating agencies play in providing a credit view in infrastructure finance. Nevertheless, the rating agencies should be removed from the regulatory architecture as far as possible, so that the market, not the regulators, determines the extent of the use of ratings.

The president of Standard & Poor's in his press release of 23rd February 2009 encouraged policymakers to consider not just the oversight of ratings businesses, but also the use of ratings by regulators and investors: "In particular, they should examine regulations that may inadvertently encourage undue reliance on ratings. If ratings are used as benchmarks of creditworthiness in regulations – which, incidentally, we have never encouraged – other benchmarks and factors should be considered as well. This would help avoid over-dependence on ratings."

For regulated industries, the effect of including an investment grade licence condition is to devolve an important element of the regulatory function to the rating agencies. But the rating agencies will increasingly become regulated themselves. It will therefore be increasingly anomalous and potentially give rise to conflicts, if the rating agencies are at the same time both regulated and regulators.

Recent proposals in relation to airports to introduce an investment grade licence condition are simply bringing airports in line with other regulated industries. But just because it is a feature of other regulated industries, this does not mean that it is right and that airports should have to follow suit. One of the arguments advanced in favour of the investment grade licence condition is that the rating agencies can give the market early warnings of trouble. However, the rating agencies' track record in providing "early warning" radar is at best mixed. Rather than require an investment grade rating, it would be far better to embed a series of explicit credit and liquidity ratios in the licence which, if tripped, would cause cashflow to be locked up within the ring fence i.e. no cash distributions. This is designed to avoid excessive withdrawal of surplus cash from the regulated business and to trigger cash trapping in adverse circumstances. A breach of the licence would only occur if these metrics then deteriorated below some higher thresholds.

The Office of Rail Regulation (ORR) has recently taken an important step in the right direction. Network Rail does not have a requirement in its licence to maintain investment grade ratings because all of its debt financing is guaranteed by the Government. On 18th June 2009, ORR launched a consultation on the level of the financial indebtedness licence condition. It is proposing a 70-75% debt to RAB ratio (compared to a projected peak level of 66.4% in the current five-year control period). In addition, it has also asked for views on whether "other financial ratios such as the adjusted interest cover ratio" should be included as one of the limits in the financial indebtedness licence condition. It would be desirable if the other economic regulators were to take similar steps to remove the rating agencies from the regulatory finance architecture.

“The effect of including an investment grade licence condition is to devolve an important element of the regulatory function to the rating agencies”

SECTION 3

Conclusions and recommendations

To deliver infrastructure investment so that it can stimulate sustainable economic growth, while addressing our significant infrastructure failures, we need to do four things. First, at a macro level we need to ensure that we move towards a sustainable consumption path – the British economy needs higher levels of savings to enable more investment. The economic crisis has raised fundamental questions about the ‘British economic model’, based upon high consumption and high borrowing. We argue that it would be better to focus on investment rather than consumption, creating assets to set against the debt. And amongst investment opportunities, infrastructure has considerable merits, not least because it increases productivity and competitiveness, as well as social inclusion.

Second, we must ensure that after the credit crunch the transmission mechanism from savings to investment is as smooth and cost-effective as it can be. This means finance must be available for infrastructure projects over long enough periods and at the lowest costs possible.

Third, we need to co-ordinate and prioritise infrastructure investments across the economy. Britain has a poor track record of doing this effectively and the plethora of government and government-sponsored organisations in this area could work more effectively if brought together.

Finally, given the size of accumulated government debt, as much infrastructure investment as possible should be undertaken off government balance sheet and by the private sector. This need not increase the costs of infrastructure projects – in fact it can reduce them significantly – as long as government creates a low-risk framework for encouraging investment.

To help to achieve these objectives, the Government should adopt the following recommendations. The choice is clear, as are the consequences. The economic crisis can prove the catalyst to a more imaginative approach to infrastructure – holding up demand, creating jobs and providing future generations with a set of assets. The Victorians did it: the current generation needs to repeat it.

Policy recommendations to raise the level of savings available for infrastructure investment:

1. **To expand retail investments in infrastructure and utilities, the Government should allow a proportion of (expanded) Individual Savings Accounts (ISAs) in this category.** While the Government has undermined

savings through monetary and fiscal policies since 2000, there have been contradictory mechanisms to encourage savings such as ISAs. One way of expanding retail investments in infrastructure and utilities is to allow a proportion of (expanded) ISAs in this category.

2. **Government should address the tax status of regulated asset base (RAB) based investments and make interest on RAB-based bonds tax free for retail and pension fund investors.** The utilities and infrastructure areas represent a good case for a priority lowering of tax on investments. Their wider public benefit is not reflected in prices, and the internalisation of these externalities from networks and low-carbon technologies merits a positive discrimination in their favour. As a result, interest on RAB-based bonds should be tax-free.
3. **Pension and life funds should be encouraged to play a greater role in channelling savings into infrastructure projects.** Pension and life funds are the principal vehicles for savings. They have long-term liabilities, and utilities have long-term time-inconsistency exposures and long-lived physical assets. The RAB provides a means through which savings can be channelled by financial institutions into infrastructure investments.

Policy recommendations to reduce the cost of capital and move infrastructure investment off the Government balance sheet:

4. **Government should significantly reduce the cost of capital for financing infrastructure projects by credibly protecting investors through reforming and expanding the number of sectors covered by a RAB.** There is a significant difference between the costs of capital under different regulatory regimes. Private finance initiative (PFI) projects have turned out to have relatively high costs of capital, whereas price-capped, RAB networks have had much lower costs of capital. A 1% change in the cost of capital on the total programme of £500 billion is worth £5 billion per annum. Hence a great deal rides upon whether the regulatory system and the role of government are designed to hold down the cost of capital. The RAB is protected by the duty that is placed upon regulators to finance the functions of the business, including the RAB. Understood in this way, the equity risk in the RAB for the company is zero – it has been transferred to the customers who are compelled to pay for the RAB (or, in the case of government guarantees and subsidies, to the taxpayers). This has a radical implication. If the RAB is guaranteed, it can be financed by debt, and that debt in turn is effectively guaranteed through the duty to finance. The cost of the RAB should therefore be very close to that of government borrowing. Indeed, were investors to lose faith in the creditworthiness of government bonds, the RAB might actually become lower risk because investors have physical assets to fall back on. In a period of inflation, this could be especially valuable security.
5. **To begin with, the RAB concept should be extended quickly to include the decarbonisation programme, high-speed rail and road transport and much**

of the PFI programme. For decarbonisation this would include renewables, nuclear and carbon capture and storage (CCS) electricity generation. The obligations and levies which have been created on an ad hoc basis can be given a solid foundation and this might be termed the Low Carbon Obligation. The RAB could also be introduced for roads, instead of current customers paying for current investment on a pay-as-you-go basis out of general tax revenue, and much of the PFI programme could be regularised in this way too. All of this would reduce the cost of capital thereby saving significant sums of money and taking significant future investment requirements off the Government balance sheet – both critically important in straitened fiscal times.

- 6. We need to adopt a more consistent regulatory approach towards the allowed return and cost of capital.** Complexity and inconsistency deter investors. Understanding the nuances of each industry every five-year cycle is not something that encourages investment – capital market participants and analysts have trouble understanding the plethora of small differences between sectors and periods. Introducing greater consistency across the various regulated sectors should lead to a lower cost of capital.

Policy recommendations to increase the availability of capital and integrate UK infrastructure policy:

- 7. The UK should establish an infrastructure bank (UKIB), which draws on elements of Infrastructure Australia, KfW in Germany and NTMA in Ireland.** It would encompass the public works loan board (PWLB), the Treasury infrastructure finance unit (TIFU) and Partnerships UK (PUK). The prize is an institution which facilitates the introduction of private sector capital without crowding it out, finances itself with a government guarantee, aims to break even with any dividends reinvested, and whose liabilities do not score in the National Accounts but whose activities are defined by national priorities. The UKIB would help to finance the construction phases of infrastructure projects before they become operational and cash flow producing. The prospective establishment of Infrastructure UK as foreshadowed in the Building Britain's Future report of July 2009 may well go some of the way towards identifying priorities, but a bank which provides finance will be significantly more effective than another advisory body or centre of excellence.
- 8. In straitened fiscal times more emphasis should be placed on recycling investment and considering the more mature assets that the Government might sell in order to free up funds for investment in greenfield projects.** The Operational Efficiency Review in the run up to the 2009 Budget has not created a framework with the right incentives. Consequently departments do not identify assets that could be sold and the proceeds reinvested. An example of this kind of missed opportunity is not selling a concession to operate and collect tolls on the Dartford crossing to fund improvement of the M25.

- 9. The Government needs to introduce national infrastructure accounts with common methodologies to calculate the infrastructure requirements of the UK economy.** It is incredibly difficult to measure precisely the scale of the infrastructure challenge we face. There is no national asset register and no national evaluation of depreciation. The immediate consequence is that it is very difficult to compare capital expenditure (capex) programmes across different sectors. As a result, any estimate of the requirements in quantitative terms is bound to be open to considerable uncertainty. It highlights how little attention has been given to these issues.
- 10. The rating agencies should be removed from the regulatory architecture where possible.** The track record of the rating agencies in providing early warning radar is at best mixed. Rather than investment grade rating requirements for regulated industries, a series of explicit credit and liquidity ratios should be embedded in regulatory licences, which, if tripped, would lock up cashflow. This is designed to avoid excessive withdrawal of surplus cash from the regulated business and to trigger cash trapping in adverse circumstances. The effect of including an investment grade licence condition is to devolve an important element of regulation to the rating agencies, which will increasingly be regulated themselves. This anomalous situation, in which rating agencies are at the same time both regulated and regulators, could give rise to conflicts.



Britain faces a tough challenge. Competing in a 21st century world with (in places) 1970s electricity infrastructure, 19th century water networks and postwar transport networks is simply not possible. A ruthlessly competitive global economy and the challenges of climate change mean that sticking-plaster updates are no longer sufficient. The UK is in need of a step change in its infrastructure provision. This report details the challenge and how to face it.

The report is divided into the two sections. The first, by Dieter Helm, discusses the importance of investment over consumption, why infrastructure is important and the scale of the investment challenge. It also looks at how infrastructure might be financed, and how the infrastructure investment fits into the wider framework of economic policy.

The second section, by James Wardlaw, suggests how Britain should proceed towards an integrated infrastructure finance policy and how the institutional architecture in this area can be improved. It also looks at the state of the UK infrastructure finance market, how to reduce risk for investors, introduce consistency across the regulators and reappraise the role of the rating agencies.

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