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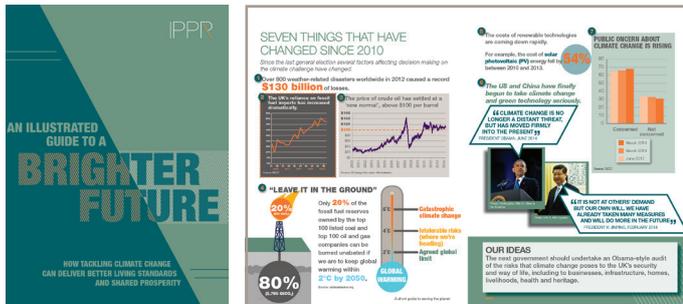
REPORT

A BRIGHTER FUTURE

HOW TACKLING CLIMATE CHANGE CAN
DELIVER BETTER LIVING STANDARDS
AND SHARED PROSPERITY

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ABOUT IPPR

IPPR, the Institute for Public Policy Research, is the UK's leading progressive thinktank. We are an independent charitable organisation with more than 40 staff members, paid interns and visiting fellows. Our main office is in London, with IPPR North, IPPR's dedicated thinktank for the North of England, operating out of offices in Newcastle and Manchester.

The purpose of our work is to conduct and publish the results of research into and promote public education in the economic, social and political sciences, and in science and technology, including the effect of moral, social, political and scientific factors on public policy and on the living standards of all sections of the community.

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IDEAS to
CHANGE LIVES

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SUMMARY

It has been known for years that climate change is happening and is man-made. The latest scientific evidence reiterates these facts, and there is growing concern that the world is heading for a catastrophic temperature rise of 4°C.

Sceptics claim that there is little point in Britain acting alone to tackle climate change while other countries – notably the US and China – continue to burn fossil fuels. However, while this may be a compelling argument, both President Obama and President Xi are now taking climate change seriously, as is documented in this report.

Since 2010, increased instances of severe weather events, rising import dependency and oil prices, and the falling costs of renewable energy have all strengthened the case for urgent action. Nearly 70 per cent of the British public are concerned by climate change, which represents a clear political mandate for action.

Addressing climate change is an important goal in its own right, but this report shows that it can help address three of the greatest challenges facing our country.

- **The consumer challenge:** energy and transport costs have spiralled and trust in markets has declined, while living standards have stagnated.
- **The capacity challenge:** there has been a lack of investment in much-needed new infrastructure, and not enough emphasis has been placed on managing existing usage of energy and transport.
- **The regional challenge:** while there has been economic recovery at the national level, there has been varied performance in terms of decent jobs and growth in our regions.

Getting our domestic policy on climate change right is vital if we are to meet the **international challenge**. The EU is losing its leadership position on climate change and needs fresh impetus, particularly since China and the US are now taking significant new steps to clean up their economies.

This report sets out each of these challenges in greater detail, and offers 17 ideas for how these problems can be addressed. These ideas centre on the need for:

- an Obama-style **audit of the risks that climate change poses** to our security and way of life here in the UK
- a shift in focus away from large-scale generation onto **energy efficiency, 'smart' demand-management tools, and smaller technologies**, so that we can realise their potential to cut bills, reduce carbon and create jobs
- **new sources of finance for low-carbon infrastructure**, particularly from communities and individuals
- **greater certainty** for all our low-carbon sectors so that businesses have a solid framework in which to grow and create decent jobs in every region.

This report accompanies the short, illustrated booklet *An illustrated guide to a brighter future*, which is available to download at ippr.org.

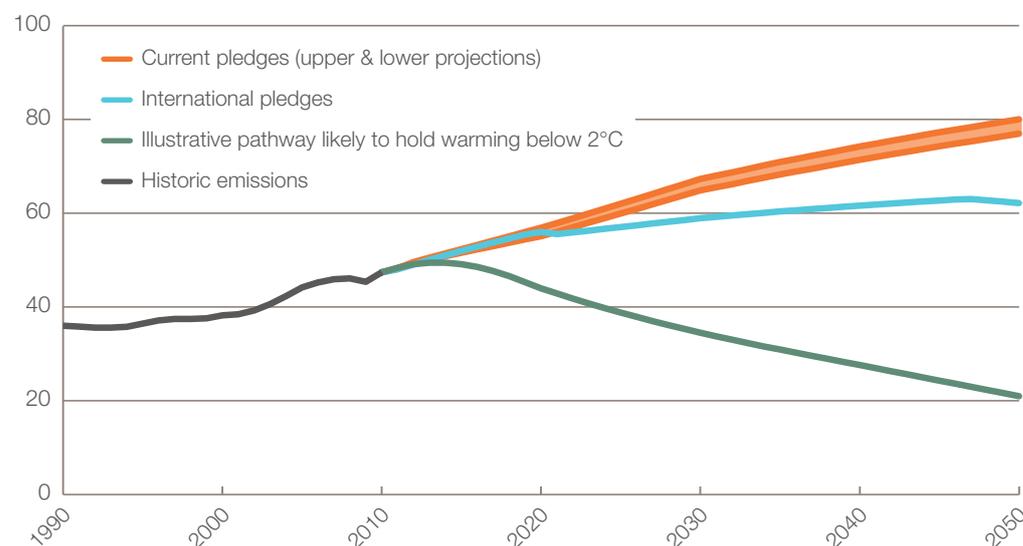
INTRODUCTION

THE CLIMATE CHALLENGE

Earlier this year the International Panel on Climate Change (IPCC 2014) published their fifth assessment report on climate change. It showed that levels of the polluting gases that are causing the global climate crisis grew nearly twice as fast in the past decade as they did in the previous 30 years. Global warming can already be observed, with surface and ocean temperatures increasing, and the Arctic melting, at an astonishing pace.

Without urgent action to reverse these trends and make deep cuts in greenhouse gas emissions there is a high risk that the average global temperature could increase by more than 2°C, as the chart below shows. Such a rise would jeopardise current levels of prosperity and decades of progress in international development. Yet scientists advise that, based on governments' current commitments, the world should expect warming at levels of between 3.0°C and 4.6°C (AFP 2014). A landmark report for the World Bank (2012) warned that a 4°C rise in global temperatures could result in extreme heat waves, declining global food stocks, the loss of ecosystems and biodiversity, and life-threatening sea-level rises.

Figure A.1
Global GHG emissions in gigatonnes of CO₂ equivalent (GtCO₂eq)



Source: <http://climateactiontracker.org/>

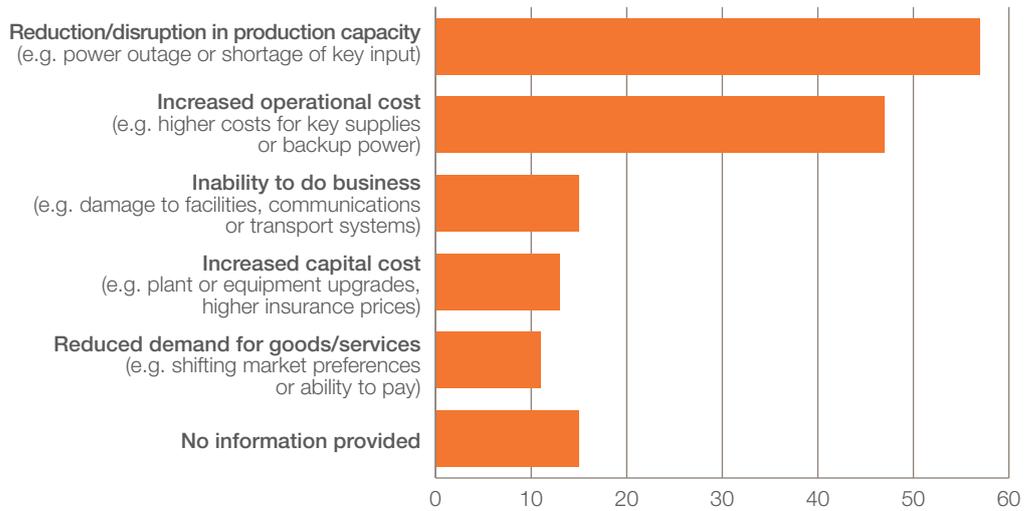
The changing economics of climate change

Alongside what is now an abundance of scientific evidence demonstrating the necessity of managing climate-change risks, the economics of doing so has also never been clearer. A number of changes have taken place since the last general election which make the urgency of action even greater.

First, the costs associated with climate change are already apparent. Worldwide, the economic cost of weather-related events climbed to near-record levels in 2012, with over 800 disasters causing estimated losses of US\$130 billion (Crawford and Seidel 2013). The top two areas of concern identified by companies listed in Standard and Poor's 'Global 100 Index' were direct impacts on production capacity, such as property damage or supply interruptions, and impacts on operational costs, such as higher commodity prices or maintenance costs (ibid).

Figure A.2

Top five current or expected impacts from a changing climate, according to companies listed in Standard and Poor's 'Global 100 Index' in 2012



Source: Crawford and Seidel 2013

Second, the UK's reliance on fossil fuel imports has increased dramatically. Until 2004, Britain was a net exporter of fossil fuels. In the late 2000s, fossil fuel imports exceeded exports by between 15 and 30 per cent. This measure of net import dependence has not been below 40 per cent since the first quarter of 2012, and peaked at 50.6 per cent in the second quarter of 2013.

Figure A.3

Net import dependency (%), Q1 2009 – Q4 2013Q



DECC 2014a

Third, the price of crude oil has settled at a 'new normal' – above \$100 per barrel (see figure A.4). This fundamentally alters the relative price of low-carbon sources. Although it is impossible to predict the direction of fossil fuel prices, it is widely believed that fossil-fuel generation will get more expensive. Recent analysis has shown that oil companies are committing \$1.1 trillion over the next decade to projects that require oil prices of above \$95 a barrel to break even (Evans-Pritchard 2014a).

Figure A.4

Daily price of crude oil (US\$ per barrel), May 1997–May 2014



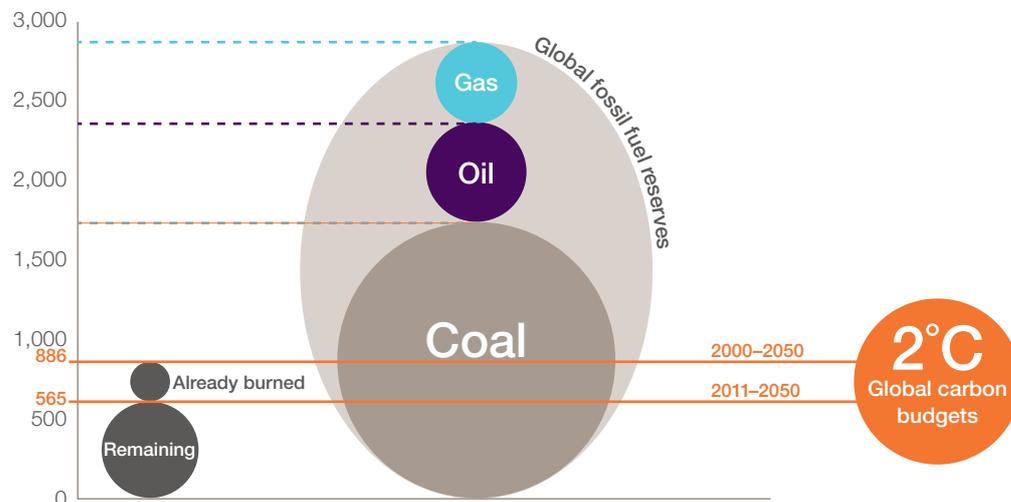
Source: EIA 2014

Fourth, new research by the Carbon Tracker Initiative has shown that only 20 per cent of the fossil fuel reserves owned by the top 100 publically listed coal companies and top 100 listed oil and gas companies can be burned unabated if we are to stay within the global 2°C 'carbon budget', as calculated by Potsdam Institute (CTI 2011). This leaves up to 80 per cent of fossil fuel assets – including those owned by numerous pension funds and other institutional investors – unburnable if dangerous climate change is to be avoided. The analysis also shows that London currently has fossil fuel reserves listed on its stock exchange with an emissions potential of 105.5 gigatonnes (Gt) of CO₂ – more than 10 times the UK's domestic carbon budget for 2011–2050 of around 10Gt of CO₂ (ibid) (see figure A.5).

Fifth, and on a more positive note, the cost of renewable technologies is falling rapidly. Bloomberg New Energy Finance claim that the cost of a unit of electricity generated by ground-mounted solar photovoltaic (PV) systems fell by 54 per cent between 2010 and 2013 (Chase 2014). There have also been significant cost reductions in onshore wind, estimated at over 7 per cent a year since 1984 (Channell et al 2013).

Figure A.5

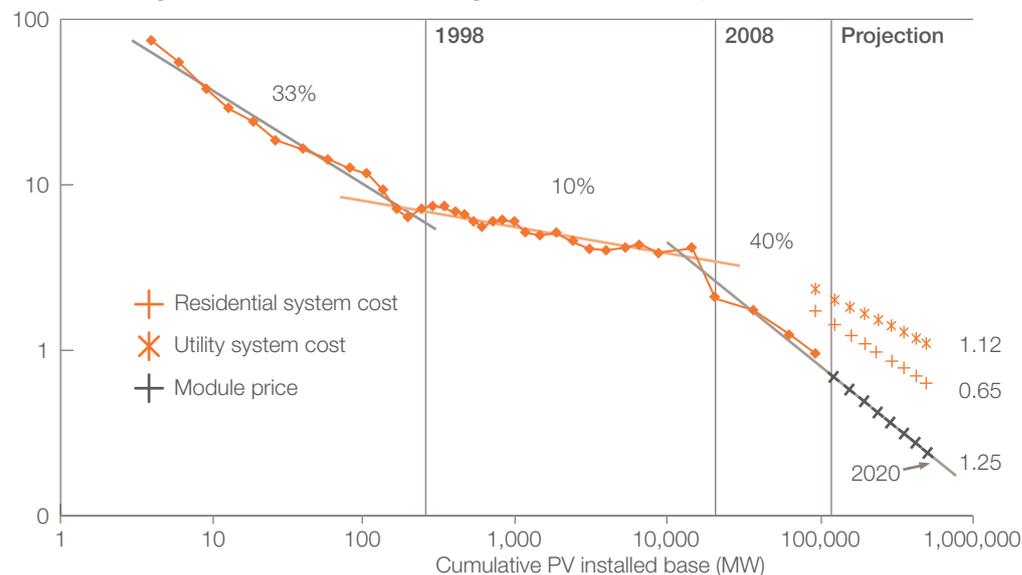
Comparison of the global 2°C carbon budget with fossil fuel reserves' CO₂ emissions potential



Source: CTI 2011: 6

Figure A.6

The cost of ground mounted solar PV generated electricity



Source: Channell et al 2013

Sixth, the US and China have finally begun to take climate change and green technology seriously, as is outlined in chapter 4. President Obama has made tackling climate change a major focus of his second term, and stated in June 2014 that 'climate change is no longer a distant threat, but has moved firmly into the present' (Obama 2014). China made climate change a major theme of its twelfth five-year plan, and President Xi has recently remarked to US secretary of state John Kerry that China is pursuing green initiatives 'not at others' demand but [of] our own will. We have already taken many measures and will do more in the future' (Yeo 2014).

Public opinion on climate change

Despite the considerable attention that those who dismiss climate change receive in the media, the overwhelming majority of the British public have remained consistent in their belief that climate change is a problem, and that it is being caused by human activity. The number of people who, when asked directly, said they were either ‘very’ or ‘fairly concerned’ about climate change rose from 65 per cent in July 2012 to 68 per cent in March 2014 (DECC 2014b). Very few people indeed – just 6 per cent – do not believe that climate change is happening at all (Barasi 2013).

That said, climate change tends not to be a priority for most people. YouGov’s (2014) issues tracker found that just 9 per cent of respondents to the most recent survey (7–8 July 2014) said that the environment was one of the three most important issues facing the country. However, this figure had spiked at 23 per cent in mid-February 2014, following a period of intense rainfall and flooding (ibid).

A Pew survey (2013a) conducted before the unprecedented wet weather last winter found that almost half of Brits thought that climate change was a major threat to Britain. Another poll, commissioned by the Department for Environment, Food and Rural Affairs (2013), found that more than 80 per cent of Brits thought that flooding had already become more frequent, and that 69 per cent agreed that ‘the UK would experience more extreme weather events by 2050’.

Public policy to manage climate change risks

To date there has been a large degree of political consensus on the necessity of tackling climate change. Both the Climate Change Act (HM Government 2008), which set binding targets to cut emissions by 80 per cent against a 1990 baseline by 2050, and the Energy Act (HM Government 2013), which put in place government policies to encourage investment in low-carbon technologies, received royal assent with cross-party support. However, these acts have also had the effect of allowing politicians to avoid confronting the public with some of the trade-offs associated with taking stronger action now to avoid greater costs in the future.

It will become far harder to keep these trade-offs away from the public glare in the next parliament, because four urgent challenges present themselves to every political party. IPPR believes that a low-carbon pathway presents the answer to each of these challenges.

1. **The consumer challenge**, which requires each party to set out how they will lower the cost of living and increase trust in markets – particularly by tackling energy and transport prices, which have increased dramatically in recent years. IPPR’s argument is that increased efficiency and improved competition are needed in order to meet this challenge.
2. **The capacity challenge**, which requires each party to set out how they will maintain security of supply in energy markets, and ease congestion in transport. IPPR argues that smarter and more decentralised energy and transport systems, and new sources of investment, are key to overcoming this challenge.
3. **The regional challenge**, which requires each party to set out how they will support well-paid and decent jobs in every region of the country. IPPR believes that creating the long-term conditions necessary for investment in low-carbon infrastructure, and developing clear industrial strategies, are the right means of answering this challenge, since these jobs exist in every region.
4. **The international challenge**, which requires each party to set out how they will approach the major international events on climate change that will take place ahead of the crucial Paris summit in winter 2015. We argue that only by maintaining momentum for an ambitious EU energy and climate package, and ensuring a climate component to the new UN sustainable development goals, can a global deal be reached.

In addition to tackling each of these challenges, each of which are explored in subsequent chapters, it is essential that an elevated public conversation – rather than just a technocratic debate – takes place about the trade-offs associated with the low-carbon transition. Equally, greater clarity is needed about the nature of the climate risks to the UK that are associated with different levels of temperature rise.

Our idea

The next government should undertake a comprehensive audit of the risks associated with different temperature-rise scenarios – including ones in which the world fails to keep the average global temperature rise below 2°C – could impact on the UK’s security and way of life, including its effects on businesses in all sectors; transport, energy and other infrastructure; homes and livelihoods; health; and heritage. This audit should emulate the National Climate Assessment instigated by President Obama in the US. It should be spearheaded and delivered by the Cabinet Office, as this would demonstrate that the audit has backing at the prime-ministerial level and enable risks to be assessed from a cross-departmental perspective. The audit should be accompanied by a widespread public dialogue to increase awareness of both the risks posed by climate change and the government’s commitment to taking action.

1. THE CONSUMER CHALLENGE

The government can raise living standards, tackle fuel-poverty and reduce emissions by reforming energy and transport markets and increasing efficiency.

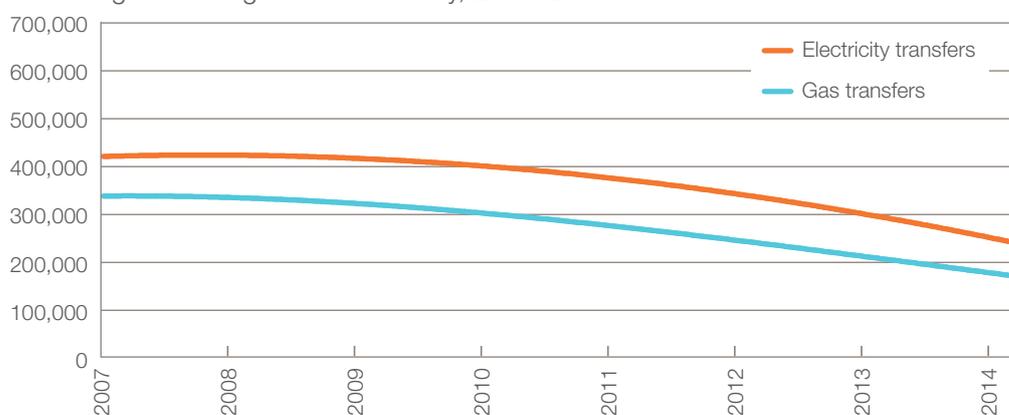
1.1 The problem

Living standards are now centre stage in British politics. A recent poll found that 80 per cent of people believe that Britain is facing a ‘crisis in the cost of living’ (Survation 2013). A separate poll found that energy prices topped a list of concerns about the biggest threat to the UK economy (Dahlgreen 2013). Putting downward pressure on the cost of living, so that household bills are as low as possible, is perceived by the public as the policy that will most help individuals and families – ahead of reducing taxes, increasing wages or reforming the welfare system (YouGov 2013).

The rise in public concern about energy prices is not surprising. The average household energy bill currently stands at £1,346 (Ofgem 2014a), up from just £610 in 2004 (CCC 2012). As the latest figures from the Committee on Climate Change (CCC) show, the vast majority of this increase was due to changes in the international price of gas, with just £75 (14 per cent) caused by policies to support investment in low-carbon technologies or energy efficiency improvements (CCC 2013a). Since 2007, bus and rail fares have increased by 12.6 per cent and 13.5 per cent above inflation respectively (DfT 2013a). Rising prices are a concern for many, but can have particularly detrimental consequences for the most vulnerable households.

Strongly linked to public concerns about high prices is the issue of trust. Trust in the energy market has collapsed: just 32 per cent of Britons trust energy companies, which makes the sector the least-trusted in the UK, behind even media and banking (Edelman 2014). Nearly three-quarters of people in the UK (73 per cent) want more regulation of the energy business – the highest figure globally (ibid). Similarly, only 45 per cent of rail passengers are satisfied that the price of their tickets gives them value for money (Passenger Focus 2014).

Figure 1.1
Switching rates for gas and electricity, 2007–2014



Source: DECC 2014c

Low levels of trust combined with rising prices create a toxic environment for policymaking. First, mistrust of energy companies can stop some consumers from engaging in the market to look for, and ultimately switch to, a cheaper tariff, as the chart below shows. This exacerbates the challenge of promoting effective competition between energy companies, and reduces the downward pressure that competition exerts (or should exert) on prices. Second, if consumers do not believe that they are getting a fair deal, there is an increased risk that they will object to paying large amounts to support necessary investments in low-carbon infrastructure, which are currently paid for through energy bills.

Decarbonising the British economy by 2050 will, in the long run, help cut costs for consumers by reducing the energy intensity of our economy, better managing the use of scarce resources, and ensuring that our energy and transport is run on fuels that have much lower input costs than fossil fuels. Nonetheless, this transition process has a number of upfront costs, particularly the capital costs of new infrastructure investments. It is therefore essential that as much as possible is done to keep energy and transport costs down, while at the same time improving consumers' confidence that they are getting a good deal.

There are three main means of achieving this.

- Discouraging inefficient use of energy so that consumers can reduce their bills.
- Undertaking reforms to improve market conditions, lower prices and improve consumer trust in both energy and transport.
- Managing peak demand better so that capacity constraints are not always addressed through expensive infrastructure upgrades.

This chapter focuses on the first two of these three approaches; the final one is dealt with in greater detail in chapter 2, which addresses the UK's 'capacity challenge'.

1.2 The current approach

To help reduce demand for energy, the government has prioritised improving thermal energy efficiency in the residential sector. It recognises that improving thermal energy efficiency is the best way to tackle fuel poverty. Unfortunately, it has failed to implement an effective energy efficiency programme.

The flagship Green Deal programme was launched in January 2013 to provide consumers with long-term loans to finance whole-house efficiency improvements. Loan repayments are made through energy bills, which are offset by the savings made from improved energy efficiency. The Green Deal thus brought an end to the provision of public subsidies for inexpensive energy efficiency measures. The impact assessment for the policy showed that the Department for Energy and Climate Change (DECC) expected around 130,000 households to finance improvements with a loan in the first year of the scheme, but by June 2014 just 3,234 households were in the process of taking out a loan or had already done so (DECC 2014d).

Faced with low levels of consumer demand, the government could have driven uptake by reducing the loan interest rate, which – at 8 per cent – has put people off. Instead, the government has redefined its measure of success, arguing that the number of energy efficiency measures installed is the critical variable, rather than the way in which these have been financed. It is true that surveys have found that between 49 per cent and 60 per cent of consumers who have had Green Deal assessments claim to have installed an energy efficiency measure after having the assessment (DECC 2014e). However, 78 per cent of these measures were funded by third parties, some of them with public subsidies through the Energy Company Obligation (ECO) programme (see below). Furthermore, there is no evidence on whether households have undertaken whole-house improvements as opposed

to simply installing individual measures. The government has recently launched a number of new financial incentives with the objective of boosting uptake of the Green Deal. While these incentives are welcome, fundamental reforms to the policy are required if it is to be successful.

Launched alongside the Green Deal, the government's ECO programme obliges energy companies to deliver efficiency improvements to both low-income homes and properties that require expensive energy efficiency measures, particularly solid wall insulation. The central flaws of this policy approach are that it extends the dominance of the biggest energy suppliers into the energy efficiency market, and that it is very poor at targeting support at the fuel-poor households who are most in need of support. Targeting is ineffective because comprehensive data on where the fuel-poor live does not exist, and so the government must use proxies for fuel poverty, such as benefit status, when establishing the energy companies' obligations. Under the government's new definition of fuel poverty, only 47 per cent of fuel-poor households are eligible for support through the policy. Moreover, 80 per cent of the funds being spent are going to households that are not fuel-poor (Platt et al 2013).

The ECO was further undermined last year when, responding to pressure from energy companies and some elements of the press, the government made major changes to the policy in order to immediately cut so-called 'green charges' on energy bills. By making these changes, the government has fundamentally damaged – perhaps fatally – the certainty required by the industry to deliver these fuel poverty measures cost-effectively. In fact, there is evidence to suggest that the energy companies have made excess profits as a result of these abrupt changes, which have yet to translate into lower bills for consumers. One estimate suggests that the energy companies could receive a windfall of £2 billion over three years (Gosden 2014). Another outcome of the changes was that the amount spent on energy efficiency was cut by around £400 million, or 30 per cent, per year (Platt and Rosenow 2014).

With energy efficiency policy failing to protect households from rising energy prices, problems in the energy markets have risen up the political agenda. This came to a head during winter 2013, when the large energy companies announced a series of inflation-busting price rises which were intensely scrutinised by the media. The government responded by launching a new annual review into the state of competition. The first of these 'State of the Market Assessments' was published by the energy markets regulator Ofgem (2014b) and recommended that the Competition and Markets Authority (CMA) carry out a full investigation of the retail energy market. This inquiry has now begun, and will be completed by the end of 2015.

The necessity of the CMA inquiry demonstrates that Ofgem has failed to properly regulate the energy markets. It is telling that many of the problems Ofgem identified in support of its recommendation for the CMA inquiry were originally identified six years ago when it undertook its energy supply probe' (Ofgem 2008). This included analysis of the overcharging of customers who had never switched supplier, and the potential problems arising from the vertically integrated business models of the big utilities. Ofgem has proved incapable of acting upon its own findings about problems with competition in order to improve market conditions.

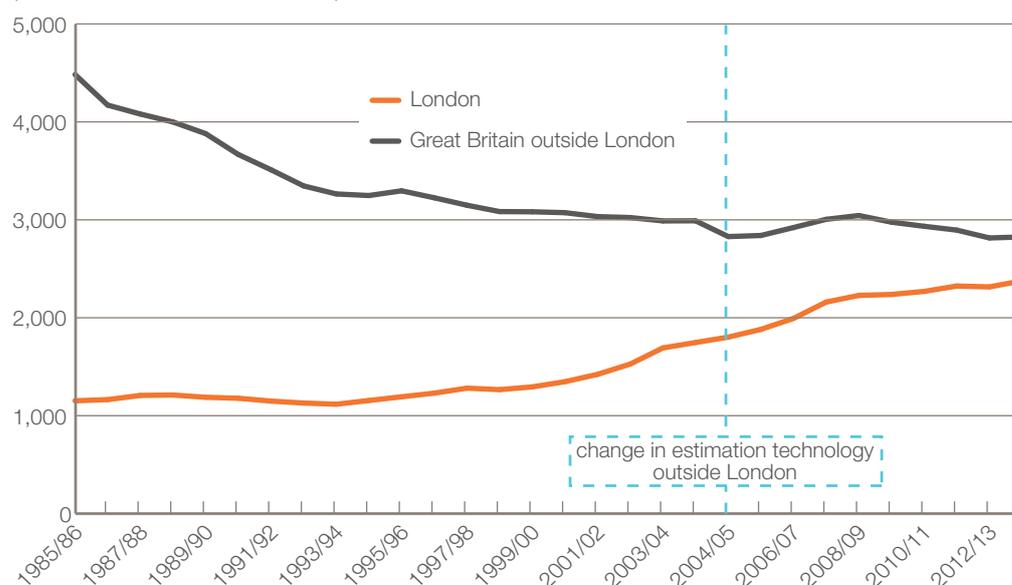
There are two overarching concerns about Ofgem's approach. The first is that its bureaucratic structure and extensive engagement processes with industry – including lengthy consultations and resource-intensive technical working groups – are best suited to the large, incumbent energy companies that can afford expensive government affairs budgets. Second, its approach to reform has prioritised increasing and simplifying information for consumers, as it attempted to do through its retail market

review (Ofgem 2013). While this is important, far more work needs to be done identify regulatory reforms that can enable disruptive technologies – such as smaller-scale generation and ‘smart’ demand reduction and response technologies – to fulfil their full potential and play a central role in creating a secure, affordable and decarbonised energy system. Key features of these new technologies are discussed in chapter 2.

Britain’s public transport markets are also in need of reform. The bus market is deregulated outside London, but this has not resulted in a competitive market: 37 per cent of weekly services outside London do not face any effective head-to-head-competition, and just 1 per cent of weekly services face effective head-to-head competition over all or most of their route (Competition Commission 2011). As a result services have suffered from rapidly rising prices and the cancellation of increasing numbers of routes. The number of bus passenger journeys outside London has fallen dramatically since liberalisation in 1986, while it has increased in London – particularly since the advent of the mayor of London and Transport for London (TfL) in 2000. The chart below illustrates this point.

Figure 1.2

Bus passenger journeys in London and in the rest of Great Britain (1,000s, 1985/86–2013/14)



Source: DfT 2013b

Note: two sets of data are shown for 2004/05.

There are some examples of local bus markets that have bucked this trend, such as those in Nottingham, Brighton and Oxford. In these cases local authorities worked effectively with bus companies to deliver better deals for citizens. In other areas, bus companies have been reluctant to cooperate with local authorities. Furthermore, taxpayer support for buses and other road-based public transport comes from four different government departments – the Departments for Transport, Health, Education, and Communities and Local Government. It is likely that this disparate approach to spending is producing substantial cost inefficiencies which could be avoided under a more unified approach.

In general, the rail market is performing better than the bus market. Rail patronage has increased by 88 per cent since privatisation, train operating companies now pay a net subsidy to government, and infrastructure subsidies are decreasing. Commuter fares have increased, but this is a deliberate policy that is in part designed to manage

demand in peak hours where patronage remains in excess of supply. It also reduces the public subsidy required by train operating companies. Ownership structures are in need of reform: current regime allows foreign state-backed companies to run our railways but prohibits a British public sector comparator, despite the fact that this would ensure that rail users are getting the best deal (Rowney and Straw 2014).

1.3 The solution

To ensure that Britain simultaneously addresses consumers' concerns about rising household bills and transport costs while bringing down carbon emissions, the UK needs a fresh approach to energy efficiency and an effective framework for promoting competition.

Improve efficiency and reduce demand

A radical overhaul of the government's energy efficiency programme is critical to bringing down bills. IPPR advocates a new, cost-effective framework that we call 'Help to Heat'. Under this framework, energy companies would no longer be responsible for delivering energy efficiency improvements to residential properties. Instead, energy efficiency spending would be devolved to local areas, and trusted local organisations – particularly local authorities – would have the opportunity to lead delivery. Second, Green Deal assessments would be carried out for free in order to stimulate demand for energy efficiency improvements and improve the targeting of fuel-poor households under the ECO. By providing assessments 'house by house' 70 per cent of available resources for targeting fuel poverty could be spent on energy efficiency improvements for fuel-poor households, as opposed to the 20 per cent that is achieved currently. Third, we call for the government to underwrite the borrowing of the Green Deal Finance Company, which issues Green Deal loans, in order to bring down the interest rates of loans. Fourth, we believe that some of the savings made through the improved targeting of the ECO programme should be used to further reduce the cost of Green Deal loans for early adopters, in order to pump-prime the market (Platt et al 2013). These reforms would involve no additional cost to either taxpayers or bill-payers.

Market reforms

Alongside efforts to improve efficiency, substantial reforms are needed to improve market conditions. The launch of the CMA inquiry is a welcome and important step, which should help to restore trust in the energy markets. Crucially, however, the inquiry must not be limited in its scope. It must include a full review of Ofgem's internal processes and organisational structure which examines whether they are fit for their purpose of supporting the development of a diverse and competitive energy market. Ofgem's approach towards potentially highly disruptive new technologies, including smaller-scale generation and demand response, must also be reviewed. Furthermore, attention must be paid to how government policy – for example, putting energy efficiency obligations on the biggest suppliers – can affect energy market competition.

In relation to public transport, bus markets outside London are ripe for reregulation. Taking some lessons from London, new transport authorities at the city-region level should be established and given powers similar to those of TfL in order to procure franchises for a mixture of profitable and unprofitable routes with clear guidance on regularity and pricing. These new regional transport bodies should be allowed to take statutory responsibility for the delivery of transport services relating to education and health. Community transport funds could be established by carving out the relevant transport budgets from other government departments. The regional transport bodies should be able to keep any savings made from achieving efficiencies, and reinvest those funds into other sustainable transport projects at the local level. These bodies should be democratically accountable, which would allow them to borrow or raise funds for infrastructure – as is the case in London

– and to retain fare receipts, as TfL does with buses. With respect to rail, it is an anomaly that French state-backed companies are able to run our franchises, but the British government or a joint venture cannot. A public sector operator should therefore be able to compete with the private sector for new franchises. These reforms would improve the outcomes of public transport markets for consumers and therefore encourage more sustainable usage of transport.

1.4 Our ideas

- **A radical overhaul of the government's energy efficiency programme is desperately needed to bring down energy bills. A dramatic raising of its ambitions should be centred on a 'Help to Heat' scheme, with responsibility for better-targetted delivery devolved to local areas in order to reduce consumers' bills.** It is no longer tenable to oblige energy suppliers to deliver energy efficiency improvements to consumers. A new model that delivers improvements 'house by house' should be introduced, with trusted local organisations playing a key role. This would create greater demand for efficiency improvements and enable resources to be better targeted at the fuel poor. The resulting savings should be used to encourage greater take-up of Green Deal loans by making them cheaper. Meanwhile, if fiscal rules allow for greater capital expenditure, residential energy efficiency should become a major component of the national infrastructure plan.
- **The CMA's inquiry into the energy markets should include a root-and-branch examination of Ofgem's ability to regulate a more diverse market facing rapid innovation.** Ofgem's processes for engaging with industry and its approach to energy market regulation should be analysed to determine whether they are fit for purpose. This should include a particular focus on whether Ofgem's regulations create or restrict opportunities for disruptive technologies. The impact of government policies on market competition should be considered.
- **Cities and regions should be given powers similar to those of TfL, in order to deliver better value for money and encourage more people to use public transport.** Where the private sector is not delivering, bus markets should be reregulated at the city-region level, with new powers over routes, regularity and pricing. A public sector operator should be able to compete with the private sector for new rail contracts. Improving public transport markets should help encourage people to use more sustainable modes of transport.
- **New regional transport bodies should be given incentives to find efficiencies in existing transport budgets, which can be passed onto consumers through lower prices and cleaner, better services.** This should include ensuring that the more than £1 billion spent by the Departments of Education and Health on local transport is devolved to the regional level so that synergies can be found; ensuring that transport appraisal focuses on enhancing demand-side management; and encouraging the use of smart-ticketing in many more regions.

2. THE CAPACITY CHALLENGE

The government can address capacity constraints in energy and transport by creating smarter and more decentralised systems, and encouraging new sources of investment.

2.1 The problem

The UK faces a substantial challenge to ensure that there is sufficient capacity in electricity supply and public transport to meet levels of demand. Capacity shortages in both sectors push up costs, but in the electricity sector there is a risk of black outs in the most extreme scenario.

The most frequently proposed approach to meeting electricity and transport capacity needs is to increase supply by building more infrastructure such as power stations, roads or railways. There is indeed a pressing need for new electricity generation to replace old power stations that are reaching the end of their operational lives, and others that must be closed down because they fall foul of regulations designed to limit pollution. This new capacity must be aligned with the UK's legal obligation to reduce carbon pollution by 80 per cent in 2050 compared to 1990 levels, and an EU target for 20 per cent of energy to be generated from renewable sources by 2020.

Alongside the need for new generation capacity, much of the electricity network requires extending and upgrading. This is essential for supporting a more diverse and decentralised set of generation assets than currently exists, and to create a 'smarter' grid that will enable vast efficiency improvements in the operation of the electricity system and to eventually reduce costs.

The government estimates that £100 billion of investment is required in new electricity generation by 2020 (DECC 2014f). When related infrastructure like interconnectors, grid improvements, port facilities and installation vessels for offshore wind are included, this figure rises to £200 billion (HOC-EAC 2014a). Additional investment of £120 billion is required in building fabric energy efficiency improvements (EBR 2014 forthcoming), and investment is also required in heating.

The investment required for transport is also high. The national infrastructure plan (HM Treasury 2013) includes £56.0 billion of investment in rail, £14.9 billion in roads and £4.5 billion in aviation.

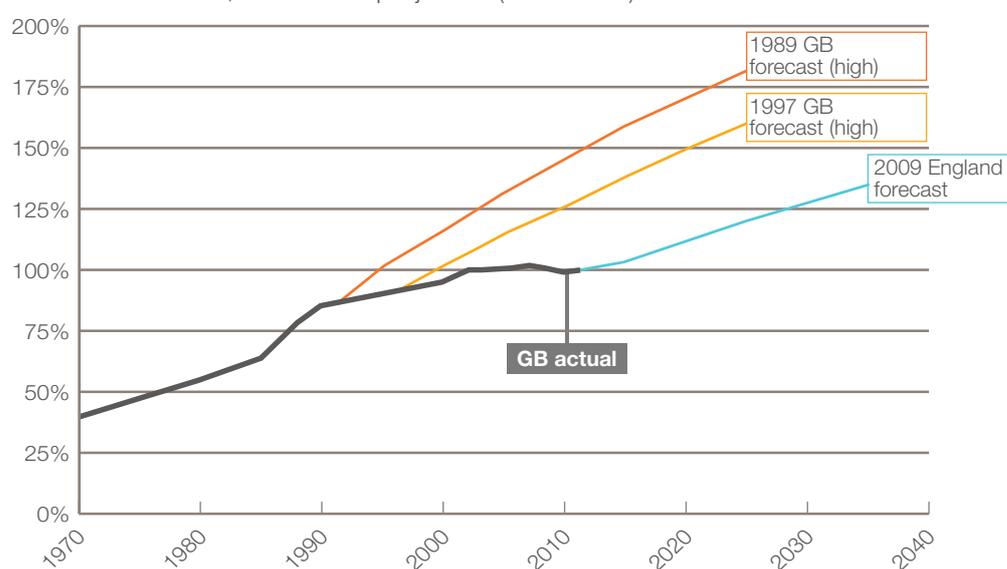
An alternative way to meet capacity challenges, which can be much cheaper than increasing supply, is to reduce and better manage existing demand. Capacity requirements for both the electricity and transport systems are put in place to meet demand at peak times, which tend to occur at the start and end of the day. There is a double dividend from reducing and smoothing peak demand. First, as stated in the previous chapter, lowering peak demand reduces the need for expensive additional capacity. Second, at times of peak electricity demand substantial costs are added to bills, because the most costly sources of generation come into use and increase the amount paid for all of the other electricity being generated. It has been estimated that, in the US, as much as 20 per cent of the total cost of providing electricity in a year comes from just four days' worth of peak demand (NPR 2010).

2.2 The current approach

There are reasons to be concerned about the current approach to tackling the capacity challenges in electricity and transport. In transport, infrastructure decisions have for years been based on a 'predict and provide' model. But the Department for Transport (DfT) has consistently overestimated future traffic growth as the chart below shows. There has been a noticeable flatlining in the number of car journeys, which demonstrates that the DfT's forecasts have been consistently overstated over the last two decades (Goodwin 2012). Instead of rising, the miles travelled and volume of traffic on the UK's strategic road network has remained virtually unchanged since 2006 (ibid). The priority given to the building of major roads reduces the funds available for other forms of infrastructure investment.

Figure 2.1

Index of car traffic, actual and projected (2003=100)



Source: Goodwin 2012

Meanwhile, no part of the UK other than London, which has implemented the successful congestion charge and complimentary policies to encourage modal shift from the car to more sustainable forms of transport, has significantly reduced demand for its roads. In rail, on the other hand, there has been a policy of above-inflation fare rises for regulated (mainly peak-time) fares, with the intention of preventing trains becoming dangerously full at peak travel times. However, the result has been to create a cliff-edge in price differences between peak and non-peak travel, rather than a smoothing of demand.

With electricity, the overarching concern is that the investment coming forward will be insufficient. Earlier this year the House of Commons' environmental audit committee warned of a 'green finance gap', with under half the annual investment required in the power sector (£8–10 billion out of £20 billion) currently being delivered. They suggest that 'a significant scale-up is needed' (HOC-EAC 2014a).

Policy uncertainty is likely to be having a detrimental effect on investment levels. The public accounts committee have stated that they 'are concerned that the complexity and changing nature of the policy landscape affecting infrastructure investment, particularly in the energy sector, may be causing investors to hold back from making investment decisions' (Nichols 2014). An important way in

which the government could provide greater certainty would be to set a 2030 decarbonisation target for the power sector, as was recommended by the CCC. This will be returned to in chapter 3.

Another challenge for raising investment is that the private sector utilities, which have been major investors in energy, are under severe financial pressure due to the transformations that are occurring in the energy system. This means that they are unable to make all of the necessary investment. Over the last six years the market value of Europe's top 20 utilities has halved, and their credit ratings are being downgraded (Schoenberg 2014). This collapse in value has occurred as financial institutions and shareholders have begun to realise the fundamental threat that small-scale generation and increased energy efficiency poses to the utility business model. Citibank (2013) suggests that these factors will lead to a halving of utility companies' market share over the next two decades, and are already 'causing the rationale of the prevailing utility business model to come under severe pressure and potentially, ultimately, crumble'.

Large-scale generation projects, which are favoured in government policy, require large-scale project developers and financiers. With the listed utilities facing financial difficulties, state-backed utilities are increasingly the biggest investors in these technologies. These utilities are therefore major beneficiaries of UK bill-payer-funded subsidies, which risks undermining public support for decarbonisation policies. In 2012, 50.4 per cent of offshore wind power generation and 68 per cent of nuclear generation in the UK was attributed to nine foreign governments, with a further small proportion attributable to German municipal authorities. These proportions are expected to increase in the coming years (Rutledge 2012, Atherton 2014).

These financing issues do not exist for smaller scale 'distributed' generation technologies, such as solar PV, medium-scale onshore wind and combined heat and power, which support a more diverse range of ownership models because of their lower capital cost. In 2012, while 10 large companies owned 85.8 per cent of all electricity generating capacity in the UK, a long tail of distributed generators owned the remaining 14.2 per cent (Rutledge 2012). Significantly, local authorities, communities and individuals are among those which are well-placed to take a stake in distributed generation, thus ensuring that the benefits from subsidies flow to communities and help to lock in support for decarbonisation policies. This has been the case in Germany, where nearly half of renewable capacity is owned by private individuals and municipal companies, while energy companies own just 12 per cent. As a result, public support for German policy on renewables is high (Morris 2013). An added attraction is that the costs of these technologies are falling very rapidly.

At present, the opportunities of distributed generation in the UK are not being captured because there is a systemic bias, in both energy regulation and policy, in favour of larger scale generation. Four examples serve to demonstrate this bias.

First, the main subsidy mechanism for renewable technologies, 'contracts for difference,' is best suited to large-scale developers because of its complex contractual arrangements. The financial risk of developing a project and then not receiving a contract is often too high for smaller developers to bear.

Second, while it is right that subsidies are reduced as technology costs fall, these reductions must be of an appropriate scale and implemented with sufficient prior warning for industry to be able to prepare. On several occasions the government has made abrupt cuts to subsidies for distributed generation, most recently for solar PV in order to protect subsidies for larger technologies. The Conservative party has made a commitment to end subsidies for new onshore wind if it is elected with a majority in May 2015, even though the technology is not yet commercially viable without financial support from government (BBC 2014).

Third, distributed generation projects have been blocked in the planning system. At the same time as implementing policies to give more local control over planning decisions involving renewables – for example, by introducing compulsory pre-application consultation with local communities for larger onshore wind applications – the secretary of state for communities and local government, Eric Pickles, has become personally involved in 45 planning decisions for onshore wind farms. As of July 2014, permission for 12 of these developments have been refused (RenewableUK 2014a).

Finally, regulatory charges for network losses and balancing fall disproportionately on smaller generators (Cornwall Energy 2014).

This systemic bias towards large-scale generation also comes at the expense of a greater focus on reducing and better managing demand. This is a missed opportunity, because demand-side measures are a far more cost-effective means of meeting the capacity challenge than focusing on supply. The government's preference for centralised supply is evident in the design of the capacity market. The government plans to reward providers of electricity demand reduction and demand response through this newly created market, but it has been designed primarily for back-up fossil fuel generation. Contracts for over 95 per cent of the capacity that will initially be procured through the market will be auctioned in December 2014 – four years in advance of when it is required (DECC 2014g). This arrangement is more appropriate for fossil fuel power plants than demand-side resources, which operate on shorter timescales. A key outcome of this is that highly polluting coal-fired power stations could be kept in operation (see chapter 4).

Britain has fallen behind on improving the efficiency of electrical appliances. Between 2005 and 2010 there was no demonstrable improvement in the average efficiency of 'white goods' bought in the UK, comparing very poorly against the EU-wide improvement of 7 per cent (GAP 2014).

Smart meters could play a central role in reducing demand peaks by enabling suppliers to offer 'time of use' tariffs, whereby prices alter throughout the day to reflect changing costs on the wholesale market. This would create a financial incentive for consumers to shift their energy usage away from peak times when prices are highest. New 'smart home' technologies – such as the Nest learning thermostat owned by Google, and UK company Passiv Systems' home energy management system – will enable consumers to benefit from the cheaper prices automatically. However, to capture the full potential of time-of-use tariffs, the rules governing payments for electricity must be reformed to reflect changes to wholesale costs at half-hourly intervals, rather than daily as occurs currently.

Moreover, it is by no means guaranteed that smart meters will be installed successfully into all 26 million households in the UK. A key risk is that consumers will reject the government's claim that competition between energy companies will ensure that cost savings from installing smart meters will be passed on. By 2030 suppliers are expected to make over £8.2 billion in savings from the smart meter roll-out, as a consequence of reduced meter readings and customer service requirements (DECC 2014h).

2.3 The solution

The first step required to address the UK's capacity challenge in electricity and transport is for existing spending commitments to be reviewed to ensure they are delivering maximum value for money. Beyond this, new sources of investment are needed in electricity infrastructure; policies and regulations must provide a level playing-field for distributed generation. Far more work must be done on demand reduction and management in both electricity and transport.

Sources of finance

With the private utilities unable to bring forward necessary levels of investment, new sources of finance are needed. Cities or groups of combined authorities at the city-region level present viable and scalable alternatives which can ensure that more of the benefits from low-carbon subsidies are returned to communities.

Several options for raising finance are already available to cities, including the Public Works Loan Board (PWLB) and the availability of EU grants. However, both of these sources are unreliable and at arms' length. Cities should pioneer a more independent avenue for raising finance by creating a collective agency for the issuance of local authority bonds, including green municipal bonds of the kind already used in South Africa (Platt et al 2014). In addition, cities should follow the example set by the Lancashire County Pension Fund, which has invested at least £193 million in low-carbon infrastructure by directing their pension fund managers to actively seek low-carbon investments. There are 101 local government pension schemes in the UK, and together they manage assets worth £150 billion (NAPF 2013). If only a small proportion of this total were invested in low-carbon projects it could have a huge impact on the UK's energy investment needs. The Green Investment Bank should also continue to provide funding to cities.

Distributed generation

Some smaller-scale generation technologies are rapidly becoming cheaper, and so offer a viable and potentially less expensive alternative to larger-scale generation technologies. The financial markets are recognising the disruptive impact that these technologies could have on the energy sector and the large-scale utility business model, but the UK's energy policy and regulation has yet to catch up. It is in the UK's interest to support these technologies because they provide a means to improve competition between energy companies, reduce costs and enable individuals, communities and local authorities to own a stake in the low-carbon transition.

For smaller-scale generation to reach its full potential, a fundamental change in approach to energy policy and regulation is required, as well as some discrete reforms. Current energy regulations – networking and balancing costs, for example – were designed for a system that is dominated by large-scale, centralised technologies, and must be overhauled. Policy decisions – whether in relation to subsidy mechanisms or planning – consistently favour larger technologies. Policymakers need to acknowledge the opportunities offered and risks posed by small-scale generation technologies, and support them accordingly.

Reducing and better managing demand

To reduce the need for costly investments in energy supply infrastructure, it is vital that reforms are implemented that provide financial incentives to energy users to reduce their consumption and shift their usage away from times of peak demand. The capacity market could have a profound impact, though not in its current form as it has been designed for back-up fossil fuel generation. It must be fundamentally reviewed.

Alongside reforms to the capacity market, another priority must be to implement – as soon as possible – the half-hourly settlement of electricity payments for domestic consumers who have a smart meter installed. Ofgem currently has no fixed timetable for implementing half-hourly settlements in the residential sector, and is committed only to performing an assessment of implementation options, which will conclude at the end of 2015. With 1.1 million smart meters already installed, this protracted process means that a major opportunity is being missed. In fact, just 345,000 of those currently installed smart meters are operating in 'smart mode' – that is, communicating usage in

real time to the benefit of consumers. The remainder are merely functioning in the same way as traditional meters (DECC 2014i).

Moreover, to ensure that the smart meter roll-out unfolds smoothly, the government must make sure that the suppliers' costs and the savings they make are fully transparent. To persist in the belief that competition alone will ensure that suppliers pass on their cost savings to consumers is clearly indefensible. Britain should also better manage electricity use by promoting the uptake of efficient electrical appliances, as many countries in Europe have done.

In transport, the roll-out of smart-ticketing that is integrated across bus and rail markets is key to managing demand at peak hours, as it is the most effective way of introducing new pricing mechanisms that allow passengers to make daily decisions about when they travel. For example, they facilitate 'shoulder pricing' – the introduction of a mid-price between off-peak and peak travel prices. This smoothes demand at the tipping point between peak and off-peak times which currently spikes either just before or just after the price change (PwC 2013).

Two key steps are required to reduce car usage. First, the planning system should be reoriented. For example, it should be ensured that new residential and commercial site developments should be well-equipped with public transport connectivity, cycle routes and secure cycle storage. Second, the motoring tax system should be reformed so that drivers are given a financial incentive to avoid unnecessary journeys. This would help reduce air pollution, carbon emissions and congestion (Rowney 2014).

2.4 Our ideas

- **In order to avoid unnecessary expenditure, a value-for-money review of all planned infrastructure should take place to ensure that it is necessary and that alternative ways of delivering capacity cannot be found.** In the context of the need for further deficit reduction in the next parliament, a zero-based review of all infrastructure projects should be carried out to ensure that capital budgets are being spent most appropriately. Infrastructure projects that reduce demand and encourage better demand management for both electricity and mass transit should be prioritised. Transport appraisals should ensure that new infrastructure projects are consistent with climate change targets, and promote better health outcomes. This should set out clear scenarios which outline how much modal shift is required to meet the 2050 decarbonisation targets. Transport appraisal and modelling frameworks, including the 'New Approach to Appraisal', should be re-evaluated to take account of this review, which would provide a basis for future investment decisions around road, rail and active transport infrastructure.
- **As traditional sources of finance dry up, reforms to investment rules are needed to make it easier for a wider range of groups – including local authorities, communities and individuals – invest in low-carbon generation and help keep the lights on.** Local authorities should be encouraged to pursue new options for raising finance for local and national energy infrastructure, including issuing municipal bonds and utilising their pension funds – as is increasingly being encouraged by the UN and OECD. The Green Investment Bank should place more emphasis on supporting local authority and community energy projects, and should be allowed to issue 'Green ISAs' to support this. These reforms would make low-carbon subsidies, which are raised from energy bills, work much harder for communities, and help to lock-in support for the low-carbon transition.

- **Subsidy allocations should be reformed so that smaller-scale generation technologies can compete with larger technologies on a level playing field.** Falling costs for some smaller generation technologies – particularly solar, onshore wind, and combined heat and power – and complimentary electricity storage technologies offer opportunities to improve competition in energy markets and bring benefits to individuals and communities. The government should acknowledge the potential of smaller-scale generation technologies; recognise that existing subsidy mechanisms, subsidy allocation frameworks and network regulations restrict this potential; and take remedial action.
- **Market incentives that realise the full potential from reducing and better managing demand in both energy and transport should be introduced.** The capacity market should be fundamentally reformed to effectively encourage demand reduction and demand management. To maximise the potential of smart meters and time-of-use tariffs, half-hourly settlements for domestic electricity consumers should be introduced as soon as possible. Suppliers must become fully transparent about the costs of installing smart meters. Meanwhile, smart-ticketing in transport should be promoted across the country.

3. THE REGIONAL CHALLENGE

The government can help create well-paid and decent jobs in every region by developing a low-carbon industrial strategy and providing the conditions for investment in low-carbon infrastructure.

3.1 The problem

After the longest recession and recovery on record, the UK economy has now passed the pre-recession peak of January 2008. Employment growth has been very strong: over 30.6 million people are now in work, representing 73 per cent of the working-age population, and unemployment has fallen faster than expected, to 6.4 per cent, although youth unemployment remains at 767,000 (ONS 2014a).

There are, however, concerns about job quality and the disappointing lack of wage growth. The percentage of temporary employees who could not find a permanent job has risen from 25 per cent in 2008 to 36 per cent in 2014, while the percentage of part-time workers who could not find a full-time job has almost doubled from 9 per cent to 17 per cent over the same period (ibid). Meanwhile, inflation continues to outstrip wage growth.

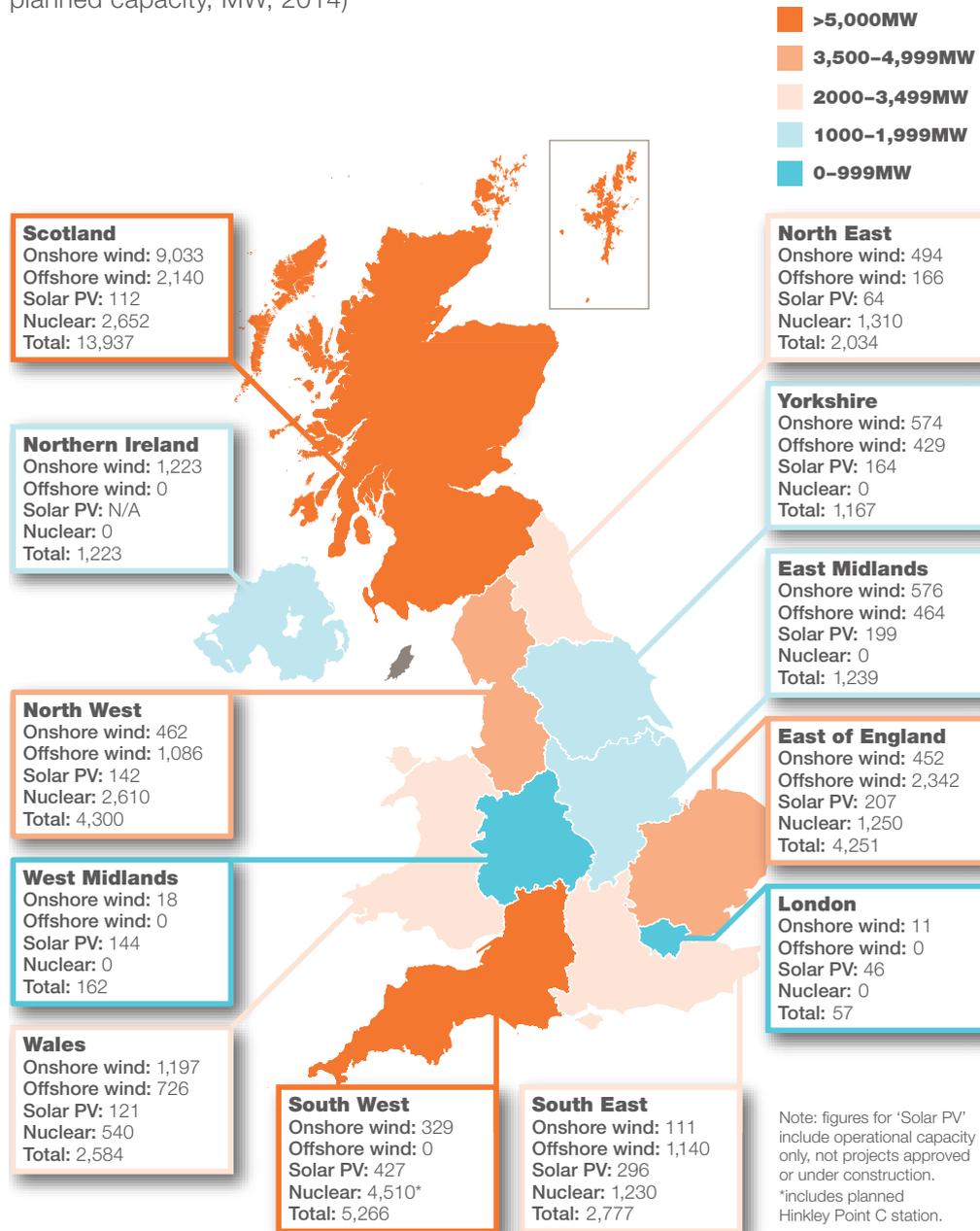
There is also a significant regional imbalance. Unemployment rates are higher than average in the North West, North East, Yorkshire and the Humber, West Midlands, London and Northern Ireland. By contrast, the employment rate in the South West, South East and East of England is several percentage points higher than in the rest of the country (ONS 2014a). Since 2007, jobs growth in London has increased by 16 per cent compared to just 2 per cent outside London (IPPR analysis of ONS 2014b and Nomis data). If regional employment rates were increased to 72 per cent the UK could raise an additional £1.3 billion in income tax, £1.8 billion in national insurance contributions, and would save £3.2 billion from the benefits bill.¹

The UK's clean technology sectors are a major source of job opportunities outside London. As the map opposite shows, the South West (5,266MW), North West (4,300MW) and East of England (4,251MW) are the three English regions with the greatest amount of approved, under construction or operational low-carbon power, and therefore related jobs. With over 9GW of onshore wind, Scotland has even more low-carbon power in total (13,937MW). Meanwhile, the country's four largest offshore wind farms in planning or development are in the North Sea (Dogger Bank, which has a target output of 7.2GW; East Anglia, 7.2GW; and Hornsea, 5GW) and Irish Sea (Celtic Array, 4.2GW) (RenewableUK 2014b). The list of eight potentially suitable sites for new nuclear power stations include two in the North West and one each in Wales and the North East (DECC 2011d). Each of these clusters could provide supply-chain opportunities for jobs during any future construction.

¹ <http://www.slideshare.net/ippr/fullemployment-slidespack>

Figure 3.1

Electricity generation capacity from low-carbon sources, by region (operational and planned capacity, MW, 2014)



IPPR analysis based on RenewableUK 2014b

3.2 The current approach

The government has adopted 11 areas upon which it is focusing its sectoral strategies. It has stated that it is backing 'those sectors which are likely to have prospects for success in the future, in terms of generating increased value added and employment in the UK economy' (BIS 2012). Within low-carbon industries, these sectors include offshore wind and nuclear, as well as the automotive industry, where there is considerable opportunity for the deployment of low-carbon technology through ultra-low-emission vehicles. However, neither onshore wind nor solar have been included in this government initiative, despite the fact that both technologies are cheaper than offshore wind. Carbon capture and storage is not included either. Nor have these sectoral approaches been adequately strategic in relation to skills, innovation, infrastructure and procurement.

In addition to treating offshore wind entirely separately from onshore wind, some parts of the government have been equivocal about the role of onshore wind in the energy mix. Following a campaign supported by 101 backbench Tory MPs, Conservative energy minister Michael Fallon recently said that the Conservative party will end subsidies for onshore wind if it wins the 2015 general election (BBC 2014, Hennessy 2012). In the 2013 autumn statement, the government announced that it would cut support for onshore wind and solar energy, but give more backing to more expensive offshore wind power.

In 2013 there was a lively debate about whether the government should seek to improve investor certainty by adopting a target to almost entirely decarbonise the power sector by 2030, as was recommended by the CCC and supported by over 100 organisations. In the end parliament narrowly voted against a proposal to include the target within the Energy Act 2013. Nor are there currently any details on the scale of clean energy subsidies after 2021; one estimate suggests that an additional £2 billion per year will be needed (CCC 2013b). These mixed signals have hampered the renewable industry, and renewable deployment is well below where it was projected to be. In 2011, DECC's *Renewable Energy Roadmap* projected 13GW of onshore wind capacity by 2020, and up to 18GW of offshore wind by 2020, with 'very high potential for deployment with over 40 GW possible by 2030' (DECC 2011b). By contrast, the latest DECC projections anticipated just 8GW of offshore and 11.2GW of onshore capacity by 2020, and only 19.7GW of offshore by 2030 (DECC 2013). The CCC has concluded:

'[DECC's central] scenario with high nuclear deployment but low investment in CCS and offshore wind during the 2020s... would imply unacceptable costs and risks of achieving the 2050 target and/or of very high electricity prices required to deploy uncommercialised low-carbon options at scale after 2030.'

CCC 2013c: 54

Energy policy uncertainty also causes problems for the low-emission vehicle industry. The Society of Motor Manufacturers and Traders and Toyota Motor Europe both told the transport select committee that government needed to ensure that the power sector had 'a coherent roadmap to deliver the resilient and decarbonised grid we need post-2025' (HOC-TC 2012).

A series of reports have shown that greater ambition in the clean energy sector increases the number of jobs per unit of power by encouraging investment in the supply chain (Carbon Trust 2008, Boettcher et al 2008, RenewableUK 2011, Cebr 2012). To date, the domestic supply chain has only delivered between 10 and 50 per cent, depending on the individual project (McNeil et al 2013). While there has been progress recently, with Siemens setting up a turbine factory in Hull, greater certainty will be needed if the UK is to secure two-thirds of the supply chain by 2030 that the government has targeted. International case studies have shown that

greater policy certainty, ministerial activism, support for key infrastructure (including ports), and greater coordination between universities, business and government on skills and innovation are all critical to reducing costs and retaining jobs.

Since Britain will retain a need for gas, with carbon capture and storage (CCS), for heating into the 2020s, shale gas exploration has some potential for reducing imports and creating jobs in the UK. Nevertheless, it is essential that a number of conditions are met before this goes ahead. First, fracking should only be allowed with the consent of local people. Second, fracking must be made as environmentally sound as possible. Third, shale must be developed alongside CCS. Lastly, the potential for fracking to cut energy bills must not be exaggerated.

In another low-carbon industry examined by IPPR – ultra-low-emission vehicles (ULEVs) – the government is not doing enough to create a vibrant domestic industry. Britain currently sells just 0.84 plug-in electric vehicles per 1,000 vehicles. This is significantly behind a number of other countries, including Norway (the global leader, at 22.75 per 1,000 vehicles), Portugal (9.05) and France (1.05) (Straw and Rowney 2013). In the US, seven times as many electric cars are sold per person than in the UK. The relatively small size of the UK's domestic market is partly why only one electric car (the Nissan LEAF) is being produced in the UK, despite a renaissance in the UK's automotive industry. If we are to guarantee more UK jobs, the government will need to do more to develop the domestic ULEV industry.

3.3 The solution

To ensure that Britain is able to create jobs and foster growth through the low-carbon transition, we need active industrial policies which provide the conditions for investment in low-carbon infrastructure, and which improve Britain's competitiveness.

In order to maximise domestic job-creation across all low-carbon sectors, the government must provide a clear and unambiguous signal of its intention to decarbonise the economy in the medium term. Relative certainty has been provided up to 2020 through the EU's climate and energy policy, but investment decisions need to be taken on a 10–20 year horizon. Since transport and heat must be electrified in the long-term, the power sector must be decarbonised first. That is why over 100 different businesses and NGOs – including Siemens, EDF Energy and Mitsubishi Power Systems – have called for a decarbonisation target for the power sector (FOE 2012).

The government has been right to identify the nuclear, offshore wind and automotive sectors as those that need particular attention because of Britain's comparative advantages and the potential for future domestic and export growth. However, as outlined above, more sectoral approaches are needed, and the existing ones need to take a more strategic approach to skills, innovation, infrastructure and procurement.

As regards skills, local enterprise partnerships, combined authorities and groups of local authorities should be given greater control over skills funding (Cox et al 2014). These democratic regional bodies should work strategically with local businesses and education providers to ensure that training programmes and degrees provide the skills necessary to build up a local workforce in areas of future demand. Many of these will relate to clean industries and their supply chains.

Growth models predict that a country's innovative capacity is, alongside population growth and capital formation, one of the main drivers of long-term growth. It is therefore essential that Britain maintains its reputation for excellence in science. 'Catapult centres', including those for offshore renewable energy, high-value manufacturing and transport systems, have been a welcome means of bringing applied research for a sector under one roof. However, Britain needs to invest far more in applied research in order to raise

our research and development expenditure, which is currently the second-lowest in the G7 after Italy, and just three-quarters of the OECD average (OECD 2014).

Thousands of jobs could be created in every region as a result of the estimated £500 billion that needs to be spent on upgrading energy, transport, communications and water infrastructure between 2010 and 2020 (Leach 2010). The Green Alliance has found that 71 per cent of planned infrastructure projects in the Treasury's pipeline are 'low carbon' projects, and just 13 per cent are 'high carbon' (Morgan 2013). However, many of these projects are struggling to find adequate finance. For example, Britain's ambition on new nuclear energy capacity has been contingent on financial support from French and Chinese state-backed companies. The Green Investment Bank is one of the current government's best institutional innovations, but it has not been given the borrowing powers that it needs to make major investments in the low-carbon economy.

The liberalised nature of the UK energy market means that the decision to build new energy generation is not subject to EU public procurement rules. This puts the UK at a disadvantage to its European neighbours. For example, the French government's approach to its procurement shows that, when combined with a high level of ministerial activism, it is possible to structure a procurement strategy to secure local content. DECC should therefore require bidders for government 'contracts for difference' to demonstrate how they might improve the economic, social and environmental wellbeing of the communities close to the proposed development.

Another potential source of jobs is the roll-out of energy efficiency measures. In addition to the infrastructure requirements outlined above, the Energy Bill Revolution (2014) estimates that £120 billion is needed to bring all UK homes up to a reasonable level of energy efficiency (Energy Performance Certificate [EPC] band 'C'). Current policy is not working: measures had been installed in just 3,234 households through the government's flagship 'Green Deal' policy by June 2014 (DECC 2014d).

IPPR has suggested that 'green jobs' – in energy efficiency for example – should form part of our proposed job guarantee scheme to find paid work for anyone who has been out of work for more than 12 consecutive months. Such jobs should be for no more than 30 hours a week to allow a reasonable amount of time for job-search, and should last a maximum of six months. These jobs could be provided by the third sector or local government.

Increasing energy efficiency in the commercial sector will not only create new jobs in every region in its own right, but could help to save jobs as well. Energy costs are placing an increasingly large burden on businesses. Between 2004 and 2011, commercial electricity prices rose by 4.8p per kilowatt hour (kWh), from just over 4.2p/kWh to just below 9.1p/kWh (CCC 2012) – an increase of around 115 per cent, compared with general price inflation of 22 per cent over the same period. No functioning Green Deal is yet in place for commercial properties, a sector that accounts for 10 per cent of total UK emissions. This leaves many SMEs and other businesses with few funding options for measures to reduce their bills. By learning from countries like the US, the Netherlands, Germany and Japan, the UK could do more to encourage the roll-out of commercial energy-efficiency.

3.4 Our ideas

- **The low-carbon economy provides jobs in every region of the country. Industrial strategies should therefore be put in place for every low-carbon sector, with a greater focus on developing appropriate skills in each region.** In addition to the sectoral strategies that already exist for nuclear energy, offshore wind and the automotive industry, strategies are

needed for onshore wind, solar energy and carbon capture and storage. All of these strategies should give greater consideration to socioeconomic factors, and give democratic regional bodies much greater coordination role over skills.

- **Jobs installing energy efficiency measures, which are needed in every region to improve our building stock and reduce energy costs for homes and businesses, should be created for those facing long-term unemployment.** A compulsory job guarantee for anyone who has been out of work for more than 12 months should be put in place. Although a number of public and third-sector organisations in different sectors will want to fill these positions, the labour intensity and geographical spread of energy efficiency make it a prime candidate for returning people in many communities to work.
- **The Green Investment Bank should be given borrowing powers with immediate effect so that it can support our low-carbon sectors and create jobs in every region of the country.** This could include an ability to issue 'Green ISAs' as a savings and investment product. To address gaps in the existing policy framework, it should focus to a greater extent on supporting commercial energy efficiency and community energy projects.
- **In order to provide certainty for the clean technology supply chain, the government should adopt the Committee on Climate Change's proposal of a 2030 decarbonisation target for the power sector of 50g of CO₂ per kWh.** This should go hand in hand with clarity on how the £2 billion per year of additional subsidies for low-carbon generation by 2030 will be financed.

4. THE INTERNATIONAL CHALLENGE

The government can ensure that global action is taken on climate change by maintaining the momentum for an ambitious EU energy and climate change package and a global deal at the UN climate summit in Paris in December 2015.

4.1 The problem

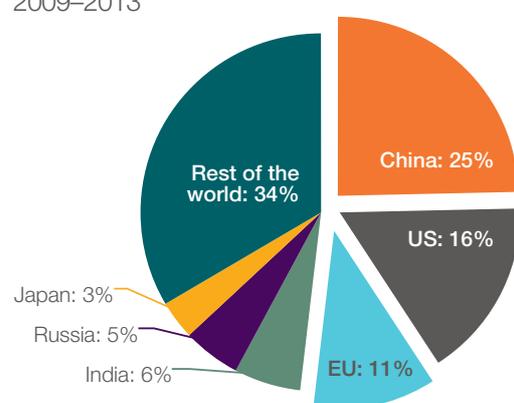
In his landmark 2007 report, Nick Stern concluded that

'Climate change is the greatest market failure the world has ever seen... [it] demands an international response, based on a shared understanding of long-term goals and agreement on frameworks for action.'

Stern 2007

International agreement has been reached that every country should have 'common but differentiated' responsibility for reducing their emissions. Countries have agreed to come forward with binding proposals by 2015 to reduce emissions in line with keeping the average global temperature rise below 2°C. Since China, the US and the EU are responsible for 52 per cent of global carbon dioxide emissions as figure 4.1 below shows, they are expected to take the lead in achieving an international response.

Figure 4.1
CO₂ emissions by country/region,
2009–2013



Source: World Bank 2014

The global financial crisis and the failure to secure a global climate agreement at the UN summit in Copenhagen in 2009 have, in combination, led to a damaging crisis of confidence over the direction of international climate and energy strategy. A sense of powerlessness has pervaded public debates, accompanied by growing controversy over what governments should do next.

Some people fear that an international agreement is unlikely due to the historical reluctance of the US to ratify international agreements. Others point to fears that whatever Europe does will be undermined by China building 'a new coal-fired power station every week'. Yet action is taking place in both countries, as outlined below.

Since the UK only produces around 2 per cent of the world's carbon pollution, multilateral diplomacy is required to manage the risks that climate change poses to Britain's prosperity. Our security depends on building greater international support for ambitious action against climate change, particularly among the world's major polluting economies. Ultimately, the UN is the right forum for this diplomacy because it exists precisely to establish and act on the common purpose of its members when there are threats to global security. There are now expectations that a deal will be reached in Paris at the end of 2015. This meeting will take place just six months after the UK's general election, making it one of the key foreign policy challenges that will face an incoming government.

For these diplomatic efforts to succeed it will be essential to prove that carbon reduction need not significantly hinder prosperity, and to demonstrate that a greener economic development pathway is realistic. To do this, we in Europe must continue to build clean energy systems ourselves. To paraphrase one of Britain's most experienced climate diplomats, John Ashton: successful diplomacy is about 'follow me' rather than 'after you' (Chatham House 2014).

Developing countries look to Britain to develop and deploy new clean energy technologies, both to see that we are not asking them to do something we ourselves will not do, and because they know that it will make these technologies more affordable. Bringing down the cost of using clean energy sources is essential to enable poorer countries to power their industrialisation without needing to rely upon polluting fuels and deforestation. Given the systemic risks associated with global warming, it is in our national interest that they follow a greener development pathway than the UK did when it was industrialising.

4.2 The current approach

In the UK there remains a cross-party consensus on enacting policies to decarbonise the economy. It was Prime Minister David Cameron who adopted new, legally-binding carbon targets to cut UK carbon pollution in half by 2025, and George Osborne who agreed to allocate £7.6 billion a year by 2020 to support the deployment of clean energy. Both Liberal Democrat energy and climate change secretary Ed Davey and his predecessor Chris Huhne have promoted a new, more ambitious European greenhouse gas reduction target for 2030, and developed legislation to offer fixed contracts for low-carbon power generators. Ed Miliband has supported these policies, and promised that a future Labour government would almost completely remove carbon from the power system by 2030.

Yet this consensus is fragile and is increasingly undermined by apparently contradictory approaches to energy policy from within the coalition. Funding for deployment of both energy efficiency measures and CCS has been cut back. The UK's carbon targets for 2027 were placed under review even as they were adopted; coalition MPs voted against a decarbonisation target for the power sector; and Conservative MEPs voted against urgently needed reforms of the EU Emissions Trading Scheme. Communities secretary Eric Pickles has intervened to block a number of wind farm projects, and the former energy minister Michael Fallon promised a moratorium on onshore wind farms (Pickard 2014, James 2014). The Liberal Democrat chief secretary to the Treasury Danny Alexander has said,

'The thing that in this job and in this government I find most frustrating is what often feels like a constant war of attrition on green issues, on renewable energy and renewable investment which is so important to our economy.'

Wintour and Watt 2012

As outlined in chapter 3, the mixed-messaging and confusion over the government's commitment to its stated low-carbon energy strategy has damaged investor confidence in clean energy. However, it has also undermined Britain's diplomatic efforts, both within Europe and further afield, to encourage low-carbon transitions in other major economies.

In Europe, coal consumption has risen in recent years: it increased by 6 per cent between 2010 and 2013. This was entirely caused by the three biggest emitters – Germany, UK and Poland. Germany's coal consumption increased by 7 per cent, the UK's increased by 19 per cent and Poland's by 2 per cent (Jones and Worthington 2014). The EU's main low-carbon policy, the Emissions Trading Scheme, has failed to put a proper carbon price in place: the cost of an allowance has stood at around €5 per tonne since the start of 2013, whereas a price of at least €25 per tonne is required for large fuel-switching to take place (IEA 2013).

4.3 The solution

Since the Kyoto Protocol was adopted in 1997, thus laying the foundations for an international solution to address the climate crisis, Europe has begun to demonstrate that building a lower carbon economy is feasible and need not hamper prosperity. Analysis by the European Environment Agency, which monitors pollution trends across our continent, shows that the EU has a much less carbon-intensive economy than it used to. By 2013, Europe's carbon emissions were down by little under 20 per cent on 1990 levels, which meant that the 2020 target was met seven years ahead of schedule (EEA 2013), while the European economy grew by 44 per cent in real terms over the same period (EC 2014). By 2020, it is likely that cuts in carbon pollution of more than 24 per cent will have taken place (EEA 2013). The data shows that this reduction is largely the result of Europe-wide climate policies designed and introduced to deploy clean energy, establish new standards for industrial polluters, and improve the overall efficiency of our energy systems.

These same policies have also been effective in kick-starting a global surge in investment in renewable energy sources over the past decade. This has brought about the creation of new jobs and industries, and a dramatic reduction in the cost of clean technologies. Renewables amounted to 44 per cent of all newly installed power generation capacity in 2013 (UNEP 2014), and the global market in these technologies now accounts for a chunk of the global economy worth US\$250 billion annually (Pew 2013b). While globally the sums invested in wind, solar and other clean sources fell by 14 per cent in 2013 (according to research by Bloomberg), this is chiefly because less money now buys more clean power thanks to the falling cost of the technologies (Walsh 2014).

The cost of solar power has more than halved since 2009 (UNEP 2014). Deutsche Bank now reports that there are 19 regional markets around the world, including in major economies like Germany and Japan, in which PV solar panels can, without subsidy, match or undercut local electricity prices for residential power (Evans-Pritchard 2014b). The cost of onshore wind has also fallen, by 15 per cent since 2009 (UNEP 2014), and the amount of installed onshore wind capacity is doubling globally every three years (Carr 2012). In the UK, industry figures suggest that onshore wind could compete with conventional power, without subsidies, as soon as 2016 (Kahya 2012). Even offshore wind is becoming more affordable, while remaining significantly more expensive than onshore wind. DONG Energy project that they could deploy offshore wind in the North Sea at a cost of £86 per megawatt hour in 2020, compared with more than £150 currently (Gosden 2013).

This revolution in the competitiveness of clean technologies is helping to make greener growth possible in China and other emerging economies. Last year China invested \$56 billion in renewable energy – more than the whole of Europe

(UNEP 2014). The country employs just under 3 million people in the sector (IRENA 2014). Severe air pollution across China has prompted Beijing to launch a major crackdown on levels of coal burning, with significant consequences for their projected output of carbon pollution. Together, these changes in China are putting momentum behind negotiations for a climate deal at the next major UN summit in Paris in 2015, and this is already being reflected in the pace and tone of international talks on the subject (Clark 2014).

Sir David King, the Foreign and Commonwealth Office special representative on climate change, reported to MPs in March 2014 that he believes China will soon announce an overall cap on coal use before 2020 (HOC-EAC 2014b). The head of China's Coal Industry Planning and Design Research Institute has said that he expects Chinese coal consumption to peak in 2020 (Xinhua 2014). As the chart below shows, 12 Chinese provinces, which together account for 44 per cent of the country's total consumption, have already pledged to cut their coal use; six have included absolute coal consumption reduction targets. Assuming that these measures are enforced, and not offset by rises in emissions elsewhere in the country, analysis by Greenpeace East Asia (Shuo 2014a) suggests that these measures could put China on a pathway consistent with limiting global temperature rises to less than 2°C. This drop in carbon pollution would be so dramatic as to be equivalent to the emissions of Australia and Canada combined. Media reports in June 2014 suggested that China would soon announce an overall cap on emissions for the period 2016–2020, and there is a lively debate in China about the date by which their country's emissions should peak (Chen and Reklef 2014, Shuo 2014b).

Figure 4.2
China's coal control measures, by province



Source: Shuo 2014c

In the US, too, there is positive change. Carbon emissions are now falling: in 2012 they dropped to their lowest level since 1994 (Pomeroy 2014), due to a switch from coal to natural gas and the more than doubling of renewable energy generation (IEA 2012). President Obama is now enacting major reforms that will lead to further reductions in carbon pollution and redouble the amount of renewable energy that

the country produces (EOP 2013). His introduction of tighter emissions standards for power stations – a move backed by two-thirds of Americans – is expected to push dozens of coal-fired power generation facilities off-line (Dizzard 2014, Goldenberg 2014a). These new standards will lead to a de-facto moratorium on new coal plant construction in America (Plumer 2012a). In addition, Obama's 2009 economic stimulus package included \$90 billion of support for clean energy investment (Plumer 2012b). Taken together, the measures described above are expected to reduce emissions from the US power sector by 30 per cent by 2030, relative to 2005 levels (Goldenberg 2014b).

The vehicle fuel-efficiency standards that the Obama administration introduced are expected to result in even greater reductions in carbon output than its policies for the power sector (Kollipara 2014). According to the US Energy Information Administration, they will reduce US oil demand by 2.2 million barrels a day by 2035 (Plumer 2012c). This domestic progress is being accompanied by a diplomatic offensive by Secretary of State John Kerry – perhaps the serving politician with the most distinguished and long-standing record of activism on climate change.

While nobody expects that there will suddenly be enough votes in the US senate for it to *ratify* a new treaty on global warming, there is every reason for investors and the rest of the international community to expect the US to *comply* with one. The domestic political conditions preventing the US from ratifying a new deal should not determine the level of climate ambition agreed to by the rest of the world. To enable the global ratification of a new UN climate treaty, other countries should therefore allow special accommodation for the US on the extent to which they are bound to their commitments in international law. The important things are that countries are reassured that nobody is moving forward alone, and that investors are given greater confidence in the fact that putting money into clean energy is a safe bet, and putting money into dirty energy is not.

International progress means that, in 2015, the world could achieve a new climate treaty that inspires confidence on these points. Yet despite the scale and importance of this opportunity, European governments have failed to make progress towards agreeing a climate and energy policy for 2030. Europe risks ceding more jobs and industrial opportunities in clean technologies to other economies that are more committed to capturing these new markets. It is in the UK's national interest that Europe urgently reinvigorates its climate strategy, and secures a deal that will both maximise the economic benefits to our citizens of the new climate agreements, and manage the risks that climate change poses to our security.

4.4 Our ideas

- **In order to encourage a global deal on climate change, Britain should support the adoption of a new, legally-binding EU-wide commitment to halve greenhouse gas pollution (on 1990 levels) by 2030**, provided there is sufficient ambition from other major economies at the UN climate summit in Paris in 2015.
- **A successful outcome to the Paris summit will be contingent on the following.**
 - **A fair contribution to finance for adaptation and low-carbon development in some of the poorest and most vulnerable countries.**
 - **Targets to cut emissions set for every five-year period with the aim of achieving carbon neutrality by 2050.**

By setting the level of global ambition for cutting greenhouse gas pollution on a rolling five-year timetable, targets could best reflect the latest climate science, economic circumstances, and what is possible given the rapidly changing cost

and nature of available low-carbon technologies. Setting these binding targets some time in advance (as the UK does currently in setting its five-yearly carbon budgets 10 years in advance) would give businesses and investors confidence that there is a clear, long-term and stable framework for agreeing emission cuts.

- **The UK must support the establishment of a global sustainable development goal specifically related to tackling climate change.** This should reaffirm that international development must be consistent with both the goal of keeping global temperatures from rising by more than 2°C, and the targets set out in any global climate treaty agreed at the Paris summit in 2015.
- **To avoid coal use increasing and undermining Britain’s commitment to a global deal, the government’s Emissions Performance Standard for carbon pollution should be extended so that the rules apply to the UK’s existing coal-fired plant.** Within the EU, the UK should push for other member states to follow the UK’s lead in addressing the resurgence of coal.

REFERENCES

- Agence France-Presse [AFP] (2014) 'Carbon plan still leaves US short of UN pledge', *Global Post* website. <http://www.globalpost.com/dispatch/news/afp/140604/carbon-plan-still-leaves-us-short-un-pledge>
- Atherton P (2014) 'How will investors work with uncertainty?', presentation at the conference 'Energy Markets at the Crossroads', 3 June 2014, London
- Barasi L (2013) 'Public opinion on energy and climate change', *Noise of the Crowd* blog. <http://www.noiseofthecrowd.com/public-opinion-on-energy-and-climate-change/>
- Boettcher M, Nielsen N P and Petrick K (2008) *Employment opportunities and challenges in the context of rapid industry growth*, Boston, MA: Bain & Company. <http://www.bain.com/Images/2008-11-01%20BB%20Wind%20energy%202008.pdf>
- British Broadcasting Corporation [BBC] (2014) 'Onshore wind farms subsidies would be scrapped by Tories', BBC News website, 24 April 2014. <http://www.bbc.co.uk/news/uk-politics-27137184>
- Carbon Tracker Initiative [CTI] (2011) *Unburnable Carbon – Are the world's financial markets carrying a carbon bubble?* London. <http://www.carbontracker.org/site/wp-content/uploads/2014/05/Unburnable-Carbon-Full-rev2-1.pdf>
- Carbon Trust (2008) *Offshore wind power: Big challenge, big opportunity – Maximising the environmental, economic and security benefits*, London. <http://www.carbontrust.com/media/42162/ctc743-offshore-wind-power.pdf>
- Carr G (2012) 'Sunny Uplands: Alternative energy will no longer be alternative', *The World in 2013* (the *Economist*), 21 November 2012. <http://www.economist.com/news/21566414-alternative-energy-will-no-longer-be-alternative-sunny-uplands>
- Centre for Economics and Business Research [Cebr] (2012) *The macroeconomic benefits of investment in offshore wind: A scenario-based assessment of the economic impacts on the UK of alternative realisations of offshore wind capacity*, London. <http://www.cebr.com/reports/economic-impact-of-offshore-wind/>
- Channell J, Jansen H R, Syme A R, Savantidou S, Morse E L and Yuen A (2013) *Energy Darwinism: The Evolution of the Energy Industry*, Citi GPS, London. <https://ir.citi.com/Jb89SJMmf%2BsAVK2AKa3QE5EJwb4fvI5UUplD0iCiG00k0NV2CqNI%2FPDLJqxidz2VAXXAXFB6fOY%3D>
- Chase J (2014) 'H1 2014 Levelised Cost of Electricity – PV', slidepack, London: Bloomberg New Energy Finance. <https://www.iea.org/media/workshops/2014/solarelectricity/BNEF2LCOEofPV.pdf>
- Chatham House (2014) 'Transcript: Only Diplomacy: Hard-Headed Soft Power for a Time of Risk, Scarcity and Insecurity: John Ashton Foreign Secretary's Special Representative for Climate Change, FCO, UK 21 February 2011', London. <https://www.chathamhouse.org/sites/files/chathamhouse/public/Meetings/Meeting%20Transcripts/210211ashton.pdf>
- Chen K and Reklef S (2014) 'CORRECTED-UPDATE 2-China plan to cap CO₂ emissions seen turning point in climate talks', *Reuters*, 3 June 2014. <http://uk.reuters.com/article/2014/06/03/china-climatechange-idUKL3N0OK1VH20140603>

- Clark P (2014) 'US and China lift climate change hopes with new phase of talks', *Financial Times*, 27 April 2014. <http://www.ft.com/cms/s/0/019f59ee-cdff-11e3-9dfd-00144feabdc0.html?siteedition=uk#axzz38NaY5uL3> (subscription required)
- Committee on Climate Change [CCC] (2012) *Energy prices and bills – impacts of meeting carbon budgets*, London. http://www.theccc.org.uk/wp-content/uploads/2012/12/1672_CCC_Energy-Bills_bookmarked.pdf
- Committee on Climate Change [CCC] (2013a) 'CCC analysis: Low-carbon policies account for only a small part of energy bill increases', blog, 23 June 2013. <http://www.theccc.org.uk/blog/ccc-analysis-low-carbon-policies-account-for-only-a-small-part-of-energy-bill-increases/>
- Committee on Climate Change [CCC] (2013b) *Next steps on Electricity Market Reform – securing the benefits of low-carbon investment*, London. http://www.theccc.org.uk/wp-content/uploads/2013/05/1720_EMR_report_web.pdf
- Committee on Climate Change [CCC] (2013c) *Fourth Carbon Budget Review – technical report: Sectoral analysis of the cost-effective path to the 2050 target*, London. http://www.theccc.org.uk/wp-content/uploads/2013/12/1785b-CCC_TechRep_Singles_Book_1.pdf
- Competition Commission (2011) *Local bus services market investigation: A report on the supply of local bus services in the UK (excluding Northern Ireland and London)*, London. http://webarchive.nationalarchives.gov.uk/+http://www.competition-commission.org.uk/inquiries/ref2010/localbus/pdf/00_sections_1_15.pdf
- Cornwall Energy (2014) *Creating Local Electricity Markets: A Manifesto for Change*, Norwich. <http://www.cornwallenergy.com/cms/data/files/Downloads/Creating-local-markets-manifesto.pdf>
- Cox E, Henderson G and Raikes L (2014) *Rebalancing the Books: How to make a 2015 spending review work for all of Britain*, Newcastle: IPPR North. <http://www.ippr.org/publications/rebalancing-the-books-how-to-make-the-2015-spending-review-work-for-all-of-britain>
- Crawford M and Seidel S (2013) *Weathering the Storm: Building Business Resilience to Climate Change*, Arlington, VA: Center for Climate and Energy Solutions. <http://www.c2es.org/docUploads/business-resilience-report-07-2013-final.pdf>
- Dahlgreen W (2013) 'Voters: energy prices are number one threat', YouGov.co.uk. <http://yougov.co.uk/news/2013/09/25/energy-prices-economic-threat/>
- Department for Business, Innovation and Skills [BIS] (2012) *Industrial strategy: UK sector analysis: BIS Economics Paper No. 18*, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/34607/12-1140-industrial-strategy-uk-sector-analysis.pdf
- Department for Environment, Food and Rural Affairs (2013) *PREPARE CA0513: Public climate risk acceptability – Final report*, London. http://randd.defra.gov.uk/Document.aspx?Document=11261_PREPARECA0513Publicclimateriskacceptability-Finalreport.pdf
- Department for Transport [DfT] (2013a) 'Table TSGB1308: Retail prices index transport components', spreadsheet, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/283409/tsgb1308.xls
- Department for Transport [DfT] (2013m) 'Table BUS0103 Passenger journeys on local bus services by metropolitan area status and country: Great Britain, annual from 1970', statistical dataset, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/320255/bus0103.xls
- Department of Energy and Climate Change [DECC] (2011a) *National Policy Statement for Nuclear Power Generation (EN-6): Volume I of II*, London https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/37051/2009-nps-for-nuclear-volumel.pdf

- Department of Energy and Climate Change [DECC] (2011b) *UK Renewable Energy Roadmap*, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48128/2167-uk-renewable-energy-roadmap.pdf
- Department of Energy and Climate Change [DECC] (2013) 'Breakdown of renewables projections in UEP 2013', spreadsheet, London. <https://www.gov.uk/government/publications/breakdown-of-renewables-projections-in-uep-2013>
- Department of Energy and Climate Change [DECC] (2014a) 'Supply and use of fuels (ET 1.3)', spreadsheet, London. <https://www.gov.uk/government/publications/total-energy-section-1-energy-trends>
- Department of Energy and Climate Change [DECC] (2014b) 'DECC Public Attitudes Tracker survey – Wave 9: Summary of headline findings', 29 April 2014. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/306898/summary_of_key_findings_wave_9.pdf
- Department of Energy and Climate Change [DECC] (2014c) 'Quarterly domestic energy switching statistics', spreadsheet, London. <https://www.gov.uk/government/statistical-data-sets/quarterly-domestic-energy-switching-statistics>
- Department of Energy and Climate Change [DECC] (2014d) *Domestic Green Deal and Energy Company Obligation in Great Britain, Monthly report*, 22 July 2014, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/332987/monthly_statistical_release_green_deal_and_eco_in_gb_22nd_july.pdf
- Department of Energy and Climate Change [DECC] (2014e) *Green Deal Assessment Customer Research: Summary Report of Further Analysis and New Findings from Quantative Surveys*, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/299499/green_deal_evaluation_additional_analysis_and_synthesis_report.pdf
- Department of Energy and Climate Change [DECC] (2014f) *Energy Investment Report April 2014*, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/305860/DECC_Energy_investment_report_Web_Final.pdf
- Department of Energy and Climate Change [DECC] (2014g) 'Britain's energy security strategy now fully in place', press release, 30 June 2014. <https://www.gov.uk/government/news/britains-energy-security-strategy-now-fully-in-place>
- Department of Energy and Climate Change [DECC] (2014h) 'Smart meter roll-out for the domestic and small and medium non-domestic sectors (GB): Impact assessment', London https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/276656/smart_meter_roll_out_for_the_domestic_and_small_and_medium_and_non_domestic_sectors.pdf
- Department of Energy and Climate Change [DECC] (2014i) *Smart Meters, Great Britain, Quarterly report to end March 2014*, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/319060/Smart_Meters_Great_Britain_Quarterly_report_to_end_March_2014_.pdf
- Dizzard J (2014) 'Checkmate for Cheap Unconventional Gas', *Financial Times*, 21 March 2014. <http://www.ft.com/cms/s/0/3ba2a206-b0f2-11e3-9f6f-00144feab7de.html#axzz30w8JEn3N> (subscription required)
- Edelman (2014) 'Energy: Edelman Trust Barometer 2014', slidepack. http://www.slideshare.net/Edelman_UK/energy-trust-barometer-2014 [Accessed 20 June 2014]
- Energy Bill Revolution [EBR] (2014 forthcoming) *The macro-economic effects of improving energy efficiency and tackling fuel poverty*, London

- US Energy Information Administration [EIA] (2014) 'Europe Brent Spot Price FOB', online data table. <http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RBRT&f=D>
- European Commission [EC] (2014) *Communication from the Commission to the European Parliament, The Council, The European Economic Social Committee and the Committee of the regions: A policy framework for climate and energy in the period from 2020 to 2030*, Brussels. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0015>
- European Environment Agency [EEA] (2013) *Trends and projections in Europe 2013: Tracking progress towards Europe's climate and energy targets until 2020*, Luxembourg: Publications Office of the European Union. <http://www.eea.europa.eu/publications/trends-and-projections-2013/full-report-ghg-trends-and-1>
- Evans-Pritchard A (2014a) 'Fossil industry is the subprime danger of this cycle', *Telegraph*, 9 July 2014 http://www.telegraph.co.uk/finance/comment/ambroseevans_pritchard/10957292/Fossil-industry-is-the-subprime-danger-of-this-cycle.html
- Evans-Pritchard A (2014b) 'Global solar dominance in sight as science trumps fossil fuels', *Telegraph*, 9 April 2014. http://www.telegraph.co.uk/finance/comment/ambroseevans_pritchard/10755598/Global-solar-dominance-in-sight-as-science-trumps-fossil-fuels.html
- Executive Office of the President [EOP] (2013) *The President's Climate Action Plan*, Washington, DC: the White House. <http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf>
- Friends of the Earth [FOE] (2012) 'Who wants a 2030 decarbonisation target?', London. http://www.foe.co.uk/sites/default/files/downloads/2030_decarb_for_against.pdf
- Global Action Plan [GAP] (2014) Promoting highly efficient electrical appliances, London. <http://www.globalactionplan.org.uk/News/promoting-highly-efficient-electrical-appliances>
- Goldenberg S (2014a) 'It's OK to say "climate change" on the campaign trail again', *Guardian Comment is Free*, 2 June 2014. <http://www.theguardian.com/commentisfree/2014/jun/02/climate-change-campaign-trail-obama-epa-rules>
- Goldenberg S (2014b) 'Obama unveils historic rules to reduce coal pollution by 30%', *Guardian*, 2 June 2014. <http://www.theguardian.com/environment/2014/jun/02/obama-rules-coal-climate-change>
- Goodwin P (2012) '*Due diligence, traffic forecasts and pensions*', Campaign for Better Transport website; originally published in *Local Transport Today*, 13 April 2012. <http://www.bettertransport.org.uk/campaigns/roads-to-nowhere/ltt-130412>
- Gosden E (2013) 'Offshore wind farm developer DONG Energy claims it can beat government cost target', *Telegraph*, 1 March 2013. <http://www.telegraph.co.uk/finance/newsbysector/energy/9901283/Offshore-wind-farm-developer-DONG-Energy-claims-it-can-beat-government-cost-target.html>
- Gosden E (2014) 'Energy companies "to reap £2bn windfall" from green levies deal', *Telegraph*, 27 Apr 2014. <http://www.telegraph.co.uk/finance/newsbysector/energy/10791736/Energy-companies-to-reap-2bn-windfall-from-green-levies-deal.html>
- Hennessy P (2012) '101 Tories revolt over wind farms', *Telegraph*, 4 February 2012. <http://www.telegraph.co.uk/news/politics/9061997/101-Tories-revolt-over-wind-farms.html>
- HM Government (2008) 'Climate Change Act 2008', London: the Stationery Office. <http://www.legislation.gov.uk/ukpga/2008/27/contents>

- HM Government (2013) *Energy Act 2013*. London: the Stationery Office. <http://www.legislation.gov.uk/ukpga/2013/32/contents/enacted/data.htm>
- HM Treasury (2013) *National Infrastructure Plan 2013*, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263159/national_infrastructure_plan_2013.pdf
- House of Commons Environmental Audit Committee [HOC-EAC] (2014a) *Green Finance: Twelfth Report of Session 2013-14 Volume I*, London: the Stationery Office. <http://www.publications.parliament.uk/pa/cm201314/cmselect/cmenvaud/191/191.pdf>
- House of Commons Environmental Audit Committee [HOC-EAC] (2014b) 'Oral evidence: Foreign Secretary's Special Representative for Climate Change, HC 1190', data.parliament.uk website. <http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/energy-and-climate-change-committee/foreign-secretarys-special-representative-for-climate-change/oral/8074.pdf>
- House of Commons Transport Committee [HOC-TC] (2012) *Plug-in vehicles, plugged in policy? Fourth Report of Session 2012-13*, London: the Stationery Office. <http://www.publications.parliament.uk/pa/cm201213/cmselect/cmtran/239/239.pdf>
- International Energy Agency [IEA] (2012) 'Global carbon-dioxide emissions increase by 1.0 Gt in 2011 to record high', press release, 24 May 2012. <http://www.iea.org/newsroomandevents/news/2012/may/name,27216,en.html>
- International Energy Agency [IEA] (2013) *Tracking Clean Energy Progress 2013: IEA Input to the Clean Energy Ministerial*, Paris. http://www.iea.org/publications/TCEP_web.pdf
- International Panel on Climate Change [IPCC] (2014) 'Summary for Policymakers', in Edenhofer O, Pichs-Madruga R, Sokona Y, Farahani E, Kadner S, Seyboth K, Adler A, Baum I, Brunner S, Eickemeier P, Kriemann B, Savolainen J, Schlömer S, von Stechow C, Zwickel T and Minx JC (eds) (2014) *Climate Change 2014: Mitigation of Climate Change: Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, UK and New York, NY: Cambridge University Press. http://report.mitigation2014.org/spm/ipcc_wg3_ar5_summary-for-policymakers_approved.pdf
- International Renewable Energy Agency [IRENA] (2014) *Renewable Energy and Jobs: Annual Review 2014*, Abu Dhabi. <http://www.irena.org/Publications/rejobs-annual-review-2014.pdf>
- James W (2014) 'Conservatives to end onshore wind farm subsidies', *Reuters*, 24 April 2014. <http://uk.reuters.com/article/2014/04/24/uk-britain-energy-windfarms-idUKBREA3N0KV20140424>
- Jones D and Worthington B (2014) 'Europe's failure to tackle coal: Risks for the EU low-carbon transition,' London: Sandbag. http://www.sandbag.org.uk/site_media/uploads/Final_Copy_Coal_Report_2014_1.pdf
- Kahya D (2012) 'Infographic: The economics of gas & wind', *Energydesk*, 4 December 2012. <http://www.greenpeace.org.uk/newsdesk/energy/data/infographic-gas-versus-wind>
- Kollipara P (2014) 'Wonkbook: Why Obama's new climate rule matters', *Washington Post*, 2 June 2014. <http://www.washingtonpost.com/blogs/wonkblog/wp/2014/06/02/wonkbook-why-obamas-new-climate-rule-matters/>
- Leach G (2010) *Infrastructure – mind the gap!*, London: Institute of Directors. http://www.iod.com/mainwebsite/resources/document/policy_article_infrastructure.pdf

- McNeil C, Rowney M and Straw W (2013) *Pump up the volume: Bringing down costs and increasing jobs in the offshore wind sector*, London: IPPR. <http://www.ippr.org/publications/pump-up-the-volume-bringing-down-costs-and-increasing-jobs-in-the-offshore-wind-sector>
- Morgan J (2013) *Infrastructure investment and the UK's economic renewal*, London: Green Alliance. <http://www.green-alliance.org.uk/resources/Infrastructure%20investment.pdf>
- Morris C (2013) 'Citizens own half of German renewable energy', *Energiewende blog*. <http://energytransition.de/2013/10/citizens-own-half-of-german-renewables/>
- National Association of Pension Funds [NAPF] (2013) *Local Government Pension Scheme 2013: investing in a changing world*, London. http://www.napf.co.uk/PolicyandResearch/DocumentLibrary/~/_media/Policy/Documents/0309_Local_Government_Pension_Scheme_2013_-_Investing_in_a_changing_world_An_NAPF_report_DOCUMENT.ashx
- National Public Radio [NPR] (2010) 'How Smart Is The Smart Grid?', *All Things Considered*, 7 July 2014 (transcript). <http://www.npr.org/templates/story/story.php?storyId=128365808>
- Nichols W (2014) 'MPs: energy policy "uncertainty" deterring investors', *BusinessGreen*, 1 July 2014. <http://www.businessgreen.com/bg/analysis/2352827/mps-energy-policy-uncertainty-deterring-investors>
- Obama B (2014), 'Remarks by the President at University of California-Irvine Commencement Ceremony', Washington DC: White House. <http://www.whitehouse.gov/the-press-office/2014/06/13/remarks-president-university-california-irvine-commencement-ceremony>
- Office for National Statistics [ONS] (2014a) 'UK Labour Market, August 2014', Newport. http://www.ons.gov.uk/ons/dcp171778_372372.pdf
- Office for National Statistics [ONS] (2014b) 'Second Estimate of GDP - Q1 2014', Newport. <http://www.ons.gov.uk/ons/rel/naa2/second-estimate-of-gdp/index.html>
- Office of Gas and Electricity Markets [Ofgem] (2008) 'Energy Supply Probe', webpage. <https://www.ofgem.gov.uk/electricity/retail-market/market-review-and-reform/retail-market-review/energy-supply-probe>
- Office of Gas and Electricity Markets [Ofgem] (2013) *The Retail Market Review – Implementation of Simpler Tariff Choices and Clearer Information*, London. https://www.ofgem.gov.uk/sites/default/files/docs/decisions/the_retail_market_review_-_implementation_of_simpler_tariff_choices_and_clearer_information.pdf
- Office of Gas and Electricity Markets [Ofgem] (2014a) 'Supply Market Indicator', webpage. <https://www.ofgem.gov.uk/gas/retail-market/monitoring-data-and-statistics/understanding-energy-prices-great-britain/supply-market-indicator>
- Office of Gas and Electricity Markets [Ofgem] (2014b) *State of the Market Assessment*, London. <https://www.ofgem.gov.uk/ofgem-publications/86804/assessmentdocumentpublished.pdf>
- Organisation for Economic Co-operation and Development [OECD] (2014) 'Main Science and Technology Indicators', online database and infographic. <http://www.oecd.org/sti/msti.htm>
- Passenger Focus (2014) *National Rail Passenger Survey: Spring 2014 Main Report*, London. <http://www.passengerfocus.org.uk/research/publications/national-rail-passenger-survey-nrps-spring-2014-main-report>

- Pew (2013a) 'Climate Change and Financial Instability Seen as Top Global Threats', Washington, DC. Online. <http://www.pewglobal.org/files/2013/06/Pew-Research-Center-Global-Attitudes-Project-Global-Threats-Report-FINAL-June-24-20131.pdf>
- Pew (2013b) 'Who's Winning the Clean Energy Race? 2013', webpage. <http://www.pewtrusts.org/en/research-and-analysis/reports/2014/04/03/whos-winning-the-clean-energy-race-2013>
- Pickard J (2014) 'Eric Pickles clamps down on onshore wind farm applications', *Financial Times*, 4 June 2014. <http://www.ft.com/cms/s/0/66eb2b74-e804-11e3-9af8-00144feabdc0.html?siteedition=uk#axzz38NaY5uL3> (subscription required)
- Platt R, Aldridge J and Washan P, with Price D (2013) *Help to Heat: A solution to the affordability crisis in energy*, London: IPPR. <http://www.ippr.org/publications/help-to-heat-a-solution-to-the-affordability-crisis-in-energy>
- Platt R and Rosenow J (2014) *Up against the (solid) wall: What changes to the ECO mean for energy efficiency policy*, London: IPPR. <http://www.ippr.org/publications/up-against-the-solid-wall-what-changes-to-the-eco-mean-for-energy-efficiency-policy>
- Platt R, Straw W, Aldridge A and Williams J (2014) *City energy: A new powerhouse for Britain*, London: IPPR. <http://www.ippr.org/publications/city-energy-a-new-powerhouse-for-britain>
- Plumer B (2012a) 'Why EPA's new carbon rules won't have much impact — for now', *Washington Post Wonkblog*, 27 March 2012. http://www.washingtonpost.com/blogs/wonkblog/post/how-much-carbon-will-the-epas-new-power-plant-rules-actually-cut/2012/03/27/gIQAuaTDeS_blog.html
- Plumer B (2012b) 'A closer look at Obama's "\$90 billion for green jobs"', *Washington Post Wonkblog*, 4 October 2012. <http://www.washingtonpost.com/blogs/wonkblog/wp/2012/10/04/a-closer-look-at-obamas-90-billion-for-clean-energy/>
- Plumer B (2012c) 'Even with strict new rules, U.S. still lags on fuel economy', *Washington Post Wonkblog*, 12 September 2012. <http://www.washingtonpost.com/blogs/wonkblog/wp/2012/09/12/even-with-stricter-new-rules-u-s-still-lags-in-fuel-economy/>
- Pomeroy R (2014) 'Rich nations' greenhouse gas emissions fall in 2012, led by U.S.', *Reuters*, 29 April 2014. <http://uk.reuters.com/article/2014/04/29/uk-climatechange-carbon-idUKKBN0DE0S220140429>
- PricewaterhouseCoopers [PwC] (2013) *Smart ticketing: A route to better and more accessible public transport services*, London. http://pwc.blogs.com/files/smartticketing-final_220813.pdf
- RenewableUK (2011) *Working for a Green Britain Volume 2 – July 2011*, London <http://www.renewableuk.com/en/publications/index.cfm/Working-for-a-Green-Britain-Volume-2>
- RenewableUK (2014a) Data provided in personal communication with IPPR, 21 July 2014
- RenewableUK (2014b) 'Offshore Wind Project Timelines – June 2014', London. <http://www.renewableuk.com/en/publications/index.cfm/Offshore-Wind-Project-Timelines>
- RenewableUK (2014c) UK Wind Energy Database, Accessed 12 August 2014. <http://www.renewableuk.com/en/renewable-energy/wind-energy/uk-wind-energy-database/index.cfm>
- Rowney M (2014) *The long road to ruin: Why the UK needs to reform motoring taxes*, London: IPPR. <http://www.ippr.org/publications/the-long-road-to-ruin-why-the-uk-needs-to-reform-motoring-taxes>

- Rowney and Straw (2014) *Greasing the wheels: Supporting and improving Britain's rail and bus services*, London: IPPR. <http://www.ippr.org/publications/greasing-the-wheels-supporting-and-improving-britain's-rail-and-bus-services>
- Rutledge I (2012) *Who owns the UK Electricity Generating Industry – and does it matter?*, Chesterfield: Sheffield Energy Resources Information Service. http://www.seris.co.uk/SERIS_%28Sheffield_Energy_Resources_Information_Services/Viewpoint_files/Who_Owns_UK-Generation_1.pdf
- Schoenberg M (2014) 'Europe's utilities should embrace role in ICT and smart infrastructure', *Guardian*, 27 May 2014. www.theguardian.com/sustainable-business/future-europe-utilities-business-model-ict
- Shuo L (2014a) 'How China's coal caps mean it may be doing more to tackle climate change than the EU and US', *Energydesk*, 10 April 2014. <http://www.greenpeace.org.uk/newsdesk/energy/analysis/how-china%E2%80%99s-coal-caps-mean-it-may-be-doing-more-tackle-climate-change-eu-and-us>
- Shuo L (2014b) 'How to interpret China's talk of a carbon "cap"', *China Dialogue*, 4 June 2014. <https://www.chinadialogue.net/blog/7020-How-to-interpret-China-s-talk-of-a-carbon-cap-/en>
- Shuo L (2014) 'Data: What is the impact of China's efforts to tackle climate change?', *Energydesk*, 3 June 2014. <http://www.greenpeace.org.uk/newsdesk/energy/data/data-how-china%E2%80%99s-coal-control-measures-could-help-avoid-catastrophic-climate-change-six-charts>
- Stern N (2007) *Stern Review: The Economics of Climate Change: Summary of Conclusions*, London. http://webarchive.nationalarchives.gov.uk/20130129110402/http://www.hm-treasury.gov.uk/d/Summary_of_Conclusions.pdf
- Straw W and Rowney M (2013) *Leading the charge: Can Britain develop a global advantage in ultra-low emission vehicles?* London: IPPR. <http://www.ippr.org/publications/leading-the-charge-can-britain-develop-a-global-advantage-in-ultra-low-emission-vehicles>
- Survation (2013) 'Cost of living poll', LabourList.org. <http://labourlist.org/wp-content/uploads/2013/10/Cost-of-Living-Report-Labour-List.pdf>
- United Nations Environment Programme [UNEP] (2014) *Global Trends in Renewable Energy Investment 2014*, Frankfurt. http://fs-unep-centre.org/sites/default/files/attachments/14008nef_visual_14_key_findings.pdf
- Walsh P (2014) 'Renewable Energy Investment Is Down – and That's OK', *Time*, 7 April 2014. <http://time.com/51834/renewable-energy-investment/>
- Wintour P and Watt N (2012) 'Danny Alexander: Tories must stop trashing green agenda', *Guardian*, 21 September 2012. <http://www.theguardian.com/politics/2012/sep/21/danny-alexander-stop-tories-trashing-green-agenda>
- World Bank (2012) *Turn Down the Heat: Why a 4°C Warmer World Must be Avoided*, Washington, DC. <http://documents.worldbank.org/curated/en/2012/11/17097815/turn-down-heat-4%C2%B0c-warmer-world-must-avoided>
- World Bank (2014) 'CO₂ emissions (kt)', database. http://data.worldbank.org/indicator/EN.ATM.CO2E.KT/countries?order=wbapi_data_value_2010%20wbapi_data_value%20wbapi_data_value-last&sort=desc
- Xinhua (2014) 'China's coal demand to peak in 2020', *China Daily*, 4 March 2014. http://www.chinadaily.com.cn/business/2014-03/04/content_17321848.htm
- Yeo S (2014), 'President Xi tells John Kerry China "will do more" on climate', Responding to Climate Change, 14 February 2014. <http://www.rtcc.org/2014/02/14/president-xi-tells-john-kerry-china-will-do-more-on-climate/>

YouGov (2013) 'YouGov/Resolution Foundation Survey Results', data tables.
http://cdn.yougov.com/cumulus_uploads/document/o9kwc8sj07/YG-Archive-Resolution-Foundation-results-280813-updated.pdf

YouGov (2014) '*YG Archives Pol Trackers Issues (2)*', data tables.
[http://d25d2506sfb94s.cloudfront.net/cumulus_uploads/document/qm59nr7l6/YG-Archives-Pol-Trackers-Issues\(2\)-080714.pdf](http://d25d2506sfb94s.cloudfront.net/cumulus_uploads/document/qm59nr7l6/YG-Archives-Pol-Trackers-Issues(2)-080714.pdf)